

B.Sc., Statistics

under CBCS with effect from the academic year 2024-25 and onwards

Learning Outcome based Curriculum

Vision of the University

To provide quality education to reach the un-reached

Mission of the University

- To conduct research, teaching and outreach programmes to improve conditions of human living.
- To create an academic environment that honours women and men of all races, caste, creed, cultures, and an atmosphere that values intellectual curiosity, pursuit of knowledge, academic freedom and integrity.
- To offer a wide variety of off-campus educational and training programs, including the use of information technology, to individuals and groups.
- To develop partnership with industries and government so as to improve the quality of the workplace and to serve as catalyst for economic and cultural development.
- To provide quality / inclusive education, especially for the rural and un-reached segments of economically downtrodden students including women, socially oppressed and differently abled.

Preamble

The **B.Sc., Statistics** degree programme of Manonmaniam Sundaranar University through its affiliated Colleges aims to provide a strong foundation for higher studies in Statistics to teach essential statistical methods for enabling the students for dealing with real world situations comprising uncertainty. It augments the ability of students to link statistical concepts and methods in other fields and to develop computer programs for carrying out essential statistical computations. It exposes towards the basic opensource software and foster interests among students to work as Statistics and Data Analytics professionals. It prepares skilled human resource for the needs of Statistics personnel in Central and State Government organizations and private sector institutions.

MANONMANIAM SUNDARANAR UNIVERSITY, TIRUNELVELI – 627 012.

B.Sc., Statistics

under CBCS with effect from the academic year 2024-25 and onwards

Eligibility for Admission:

Candidates who have passed the higher secondary examination conducted by Government of Tamil Nadu with Statistics / Mathematics / Business Statistics / Business Mathematics /Computer Science as one of the courses or other equivalent examinations are eligible for admission to the first year of the B.Sc., (Statistics) degree program.

Duration of the Program:

The duration of the program is three academic years comprising of six semesters with two semesters in each academic year. Examinations will be conducted at the end of each semester for the respective courses.

Medium of Instructions and Examinations:

The medium of instructions and examinations for the courses of Part I and Part II shall be in the languages concerned. For the courses of Part III and Part IV, the medium of instructions and examinations shall be in English.

Examination

The regulations for examination, passing minimum in each course and classification of successful candidates and award of ranks are at par with the regulations for other undergraduate science programs of the University.

SCHEME OF EXAMINATION

Sem. (1)	Pt. I/II/III/IV (2)	Course No. (3)	Course Category (4)	Course Title (5)	Contact Hrs./week (6)	L Hrs. / week (7)	T Hrs. / week (8)	P Hrs. / week (9)	C Credits (10)
I	I	1	Language	Tamil	6	6	0	0	3
	II	2	Language	English	6	6	0	0	3
	III	3	Core-I	Descriptive Statistics	4	3	0	1	4
	III	4	Core-II	Probability Theory	4	3	0	1	4
	III	5	Elective -I	Mathematics for Statistics-I	4	4	0	0	3
	III	6	Practical-I	Statistics Practical-I	2	0	0	2	2
	IV	7	SEC-I (Skill Enhancement Course)	Basics of Statistics using MS-Excel	2	2	0	0	2
	IV	8	Skill Enhancement (Foundation Course)	Office Automation	2	2	0	0	2
Subtotal					30	26	0	4	23
II	I	9	Language	Tamil	6	6	0	0	3
	II	10	Language	English	4	4	0	0	3
	III	11	Core-III	Matrix and Linear Algebra	4	3	0	1	4
	III	12	Core-IV	Distribution Theory	4	3	0	1	4
	III	13	Elective – II	Real Analysis	4	4	0	0	3
	III	14	Practical-II	Statistics Practical-II	2	0	0	2	2
	IV	15	SEC-II (Skill Enhancement Course)	Mathematics for Statistics-II	2	2	0	0	1
	IV	16	SEC-III (Skill Enhancement Course)	Programming in C++	2	2	0	0	1
	IV	17	NM	Nann Mudhalvan	2	2	0	0	2
Subtotal					30	26	0	4	23
III	I	18	Language	Tamil	6	6	0	0	3
	II	19	Language	English	6	6	0	0	3
	III	20	Core - V	Estimation Theory	4	3	0	1	4
	III	21	Core - VI	Sampling Techniques	4	3	0	1	4
	III	22	Elective - III	Numerical Methods (Discipline Specific)	4	4	0	0	4
	III	23	SEC-IV (Skill Enhancement Course)	Statistical Practical - III	2	0	0	2	2
	IV	24	NM	Nann Mudhalvan	2	2	0	0	2
	IV	25	EVS	Environmental Studies	2	2	0	0	2
Subtotal					30	26	0	4	24

IV	I	26	Language	Tamil	6	6	0	0	3
	II	27	Language	English	6	6	0	0	3
	III	28	Core - VII	Testing of Statistical Hypothesis	4	3	0	1	4
	III	29	Core - VIII	Actuarial Statistics	4	3	0	1	4
	III	30	Elective - IV	Economic & Official Statistics (Discipline Specific)	4	4	0	0	4
	III	31	SEC-V (Skill Enhancement Course)	Statistics Practical - IV	2	0	0	2	2
	IV	32	NM	Nann Mudhalvan	2	2	0	0	2
	IV	33	VE	Value Education	2	2	0	0	2
Subtotal					30	26	0	4	24
V	III	34	Core - IX	Stochastic Processes	5	4	1	0	4
	III	35	Core-X	Regression Analysis	5	4	1	0	4
	III	36	Core-XI	Statistics Practical - V	5	0	1	4	4
	III	37	Core-XII	Project with Viva voce	5	5	0	0	4
	III	38	Elective-V	Operations Research (Discipline Specific)	4	4	0	0	3
	III	39	Elective-VI	Econometrics / Population Studies	4	4	0	0	3
	IV	40	NM	Nann Mudhalvan	2	2	0	0	2
	IV	41	-	Internship / Industrial Training / Field visit / Knowledge updating	0	0	0	0	1
Subtotal					30	23	3	4	25
VI	III	42	Core - XIII	Design of Experiments	6	4	2	0	4
	III	43	Core - XIV	Demography	6	4	2	0	4
	III	44	Core-XV	Statistics Practical - VI	6	0	2	4	4
	III	45	Elective-VII	Statistical Quality Control	5	4	1	0	3
	III	46	Elective-VIII	Time Series / Index numbers	5	4	1	0	3
	IV	47	NM	Nann Mudhalvan	2	2	0	0	2
	IV	48	Extension activity	Extension Activity	0	0	0	0	1
Subtotal					30	18	8	4	21

Note 1: Examination shall be conducted on contents of UNIT I through UNIT V only.

Note 2:

Statistics Practical – I : Based on the courses Descriptive Statistics and Probability Theory

Statistics Practical – II : Based on the courses Matrix and Linear Algebra and Distribution Theory

Statistics Practical – III : Based on the courses Estimation Theory and Sampling Techniques

Statistics Practical – IV : Based on the courses Testing of Statistical Hypothesis and Actuarial Statistics

Statistics Practical – V : Based on the courses Stochastic Processes and Regression Analysis

Statistics Practical – VI : Based on the courses Design of Experiments and Demography

Programme Outcomes (POs)

On completion of the B.Sc., Statistics degree programme, the students will be able to

- P01: Pursue higher studies in Statistics
- P02: Apply knowledge on statistical methods to the real-world problems
- P03: Select and apply appropriate statistical methods for analyzing given database and to make meaningful interpretations
- P04: Draw relevant inferences in decision-making problems involving uncertainty
- P05: Plan and conduct sample surveys
- P06: Develop computer programs and to use statistical software for carrying out statistical computations and data analysis
- P07: Succeed in national and state level competitive examinations; to work as Statistics personnel in Central and State Government organizations and private sector institutions

Programme Specific Outcomes (PSOs)

On completion of the B.Sc., Statistics degree programme, the students will be able to

- PS01: Plan sample surveys and analyze the outcomes
- PS02: Handle data sets and describe their inherent properties employing knowledge acquired on statistics software
- PS03: Select and apply appropriate statistical methods for analyzing data
- PS04: Understand, Interpret and explain the relationships among the characteristics in the data
- PS05: Learn the procedures for making optimal inferences in decision making situations
- PS06: Solve mathematical problems applying statistical theory
- PS07: Develop computer programs for statistical computations

SYLLABUS

SEMESTER – I

1. TAMIL

2. ENGLISH

3. DESCRIPTIVE STATISTICS

Course Code	TITLE OF THE COURSE	L	T	P	C
Core	DESCRIPTIVE STATISTICS	3	0	1	4
Prerequisites	Basic knowledge of Statistics	Syllabus Version		2024-25	

L: Lecture T: Tutorial P: Practical C: Credits

Course Objectives:

The main objectives of this course are to

- Understand the origin, significance and scope of Statistics.
- Know the significance of presenting data in the form of tables and diagrams.
- Learn computational aspects of basic statistical measures.

Course Outcomes (COs):

At the end of this course of study, the student will be able to

CO No.	Course Outcome	Cognitive Levels
CO1	Understand the scope and necessity of Statistics.	K1, K2
CO2	Able to obtain, tabulate and present the data in tables, diagrams and graphs.	K1-K3 and K5
CO3	Apply the formula and compute descriptive measures of statistics.	K2, K3
CO4	Analyze the importance of the data and interpret the calculated results	K2, K4
CO5	Able to choose appropriate curves and to fit them for given data	K1-K3
CO6	Develop computer programs for carrying out computations related to this course	K1 –K6
K1: Remember K2: Understand K3: Apply K4: Analyze K5: Evaluate K6: Create		

Course Outline:

Unit - I

Origin, scope, limitations and misuses of Statistics – Collection – Classification - Tabulation of data. Population and Sample - Types of Data – Nominal, ordinal, Interval and ratio. Diagrammatic and graphic representation of data: line diagram, frequency polygon, frequency curve, histogram and Ogive curves.

Unit - II

Measures of central tendency: mean, median, mode, geometric mean and harmonic mean. Partition values: Quartiles, Deciles and Percentiles. Measures of Dispersion: Mean deviation, Quartile deviation and Standard deviation – Coefficient of variation. Skewness and Kurtosis.

Unit - III

Linear correlation - scatter diagram, Pearson's coefficient of correlation, computation of co-efficient of correlation from a bivariate frequency distribution, Rank correlation-Simple linear regression equations - properties of regression coefficients

Unit - IV

Curve fitting: principle of least squares, fitting of the curves of the form $y = a+bx$, $y = a+bx+cx^2$ and Exponential and Growth curves.

Unit – V

Theory of Attributes: Introduction – Definition-Classes and Class frequencies-Consistency of data-Independence of attributes-Association of attributes-Yule's coefficient

UNIT VI

Contemporary Issues: Expert lectures, online seminars – webinars. [2 hours]

BOOKS FOR STUDY:

1. Gupta, S.C. and V.K. Kapoor (2020) Fundamentals of Mathematical Statistics, Sultan Chand & Sons, New Delhi.
2. Goon, A.M., M.K. Gupta and B. Das Gupta (2017) Fundamentals of Statistics- Vol. I. World Press Ltd, Kolkata.
3. Agarwal, B. L. (2013). Basic Statistics, New Age International Private Limited, New Delhi, India

BOOKS FOR REFERENCE:

1. Anderson, T.W. and Sclove, S.L. (1978) Introduction to Statistical Analysis of data, Houghton Mifflin, Boston.
2. Bhat, B.R., Srivenkataramna, T. and Madhava Rao, K.S. (1996) Statistics: A Beginner's Text, Vol. I, New Age International, New Delhi.
3. Croxton, F.E. and Cowden, D.J. (1969) Applied General Statistics, Prentice Hall, New Delhi.

4. Spiegel, M.R. and Stephens, L. (2010) Statistics, Schaum's Outline Series, Mc Graw Hill, New York.
5. Holcomb, Z. C. (2017). Fundamentals of Descriptive Statistics, Routledge, New York.

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

1. <https://nptel.ac.in/courses/111/104/111104120/>
2. https://www.iiserpune.ac.in/~bhasapat/phy221_files/curvefitting.pdf
3. <https://www.toppr.com/guides/maths/statistics/bar-graphs-and-histogram/>
4. <https://nptel.ac.in/courses/111/104/111104098/>

Mapping of Course Outcomes to Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	High	High	High	High	Medium	High	High
CO2	High	High	High	High	Medium	High	High
CO3	High	High	Medium	Medium	Low	High	High
CO4	High	High	High	Medium	Medium	High	High
CO5	High	Medium	Medium	High	Low	High	High
CO6	Medium	High	Medium	High	Low	High	High
Correlation Level: LowMediumHigh							

Mapping of Course Outcomes to Programme Specific Outcomes

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	Medium	High	High	High	Medium	High	High
CO2	Medium	High	High	High	High	High	High
CO3	Medium	High	High	High	High	Low	Medium
CO4	High	High	High	High	High	High	Medium
CO5	Medium	High	High	Medium	Medium	High	High
CO6	High	High	High	High	High	Low	High
Correlation Level: LowMediumHigh							

4. PROBABILITY THEORY

Course Code	TITLE OF THE COURSE	L	T	P	C
Core	Probability Theory	3	0	1	4
Prerequisites	Basic knowledge of Probability and distributions	Syllabus Version		2024-25	

L: Lecture T: Tutorial P: Practical C: Credits

Course Objectives:

The main objectives of this course are to

- Inculcate knowledge of basic concepts of probability theory
- Explore the concepts of random variable, distribution function, expectation and inequalities

- Enhance the ability to prove fundamental theorems related to the convergence of sequences of random variables and distribution functions
- Inculcate the students with the practice of solving problems related to characteristic functions and convergence properties of sequences of random variables and distribution functions

Course Outcomes (COs):

At the end of this course of study, the student will be able to

CO No.	Course Outcome	Cognitive Levels
CO1	Understand the basic concepts of probability theory	K1, K2
CO2	Understand and obtain the CDF, Expectations, Moments and Inequalities.	K1-K3 and K5
CO3	Describe the concepts of convergence and their implications.	K2, K3
CO4	Understand and analyze the importance of Independence and Law of large numbers	K2, K4
CO5	Describe the Central Limit Theorem and its applications	K1-K3
CO6	Develop computer programs for carrying out computations related to this course	K1 –K6
K1: Remember K2: Understand K3: Apply K4: Analyze K5: Evaluate K6: Create		

Course Outline:

Unit - I

Probability: sample space – Events - algebraic operations on events- definition of probability - independent events – conditional probability - addition and multiplication theorems of probability – Bayes Theorem.

Unit - II

Random variables: Discrete and continuous random variables – distribution function - properties – probability mass function and probability density function – discrete and continuous probability distributions.

Unit - III

Multiple random variables: Joint, marginal and conditional distribution functions - independence of random variables – transformation of random variables and their distribution functions.

Unit - IV

Mathematical expectation: Expectation – properties – Cauchy - Schwartz inequality, conditional expectation and conditional variance. Moment generating function, characteristic function, probability generating function and their properties. Chebyshev’s inequality.

Unit - V

Limit Theorems: convergence in probability, weak law of large numbers – Bernoulli’s theorem, Khintchine’s theorem (statements only) - Central limit theorems with simple problems.

UNIT VI

Contemporary Issues: Expert lectures, online seminars – webinars. [2 hours]

BOOKS FOR STUDY:

1. Bhat B.R.(2019) Modern Probability Theory, New Age International Publishers, New Delhi.
2. Gupta, S.C. and V.K. Kapoor (2020) Fundamentals of Mathematical Statistics, Sultan Chand & Sons, New Delhi.
3. Goon, A.M., M. K. Gupta and B. Das Gupta (2017) Fundamentals of Statistics- Vol. I., World Press, Ltd, Kolkata.

BOOKS FOR REFERENCE:

1. Robert, V. Hogg, Joseph W. McKean and Allen T. Craig (2013) Introduction to Mathematical Statistics (Seventh Edition), Pearson Education, New York.
2. Lipschutz, S. (2008) Probability Theory (Second Edition), Schaum's Outline Series, McGraw Hill, New York.
3. Alexander, M. Mood, Franklin A. Graybill and Duane C. Boes (2017). Introduction to the Theory of Statistics (Third Edition), Mc Graw Hill Education, New Delhi.
4. Bhuyan K.C. (2010), Probability Distribution Theory and Statistical Inference, New Central Book Agency (P) Ltd., New Delhi.
5. Spiegel, M.R. and Ray, M. (1980) Theory and Problems of Probability and Statistics, Schaum's Outline Series, McGraw Hill, New York.
6. Rohatgi, V. K. and A. K. Md. E. Saleh (2009). An Introduction to Probability Theory and Mathematical Statistics (Second Edition). John Wiley & Sons, New York

Related Online MOOCs Contents [SWAYAM, NPTEL, Websites etc.]

1. <https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=+u3y6UdbIvOJ97LFeSCmHQ==P-01>. Probability I
2. <https://nptel.ac.in/courses/111101004>
3. <https://nptel.ac.in/courses/111104079>

Mapping of Course Outcomes to Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	High	High	High	High	Medium	High	High
CO2	High	High	High	High	Medium	High	High
CO3	High	High	Medium	Medium	Low	High	High
CO4	High	High	High	Medium	Medium	High	High
CO5	High	Medium	Medium	High	Low	High	High
CO6	Medium	High	Medium	High	Low	High	High
Correlation Level:	LowMediumHigh						

Mapping of Course Outcomes to Programme Specific Outcomes

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	Medium	High	High	High	Medium	High	High
CO2	Medium	High	High	High	High	High	High
CO3	Medium	High	High	High	High	Low	Medium
CO4	High	High	High	High	High	High	Medium
CO5	Medium	High	High	Medium	Medium	High	High
CO6	High	High	High	High	High	Low	High
Correlation Level: <i>LowMediumHigh</i>							

5. MATHEMATICS FOR STATISTICS - I

Course Code		TITLE OF THE COURSE	L	T	P	C
Core		MATHEMATICS FOR STATISTICS	4	0	0	3
Prerequisites		Basic knowledge of Real number system and Calculus	Syllabus Version		2024-25	

Course Objectives:

The main objectives of this course are to

- Understand the concept of Tangent and polar coordinates
- Know the method of finding the envelop and Curvature
- Learn computational aspects of multiple and infinite integral
- Acquire the knowledge on Homogeneous, Non-homogeneous and Linear equations.

Course Outcomes (COs):

At the end of this course of study, the student will be able to

CO No.	Course Outcome	Cognitive Levels
CO1	Understand the scope and necessity of Tangent and polar coordinates	K1, K2
CO2	Obtain the values of different types of curvature	K1-K3 and K5
CO3	Apply the formula and compute the different types of integrals	K2, K3
CO4	Evaluate integrals using Beta and Gamma functions.	K2, K4
CO5	Construct Homogeneous, Non-homogeneous and Linear equations.	K1-K3
CO6	Develop computer programs for carrying out computations related to this course	K1 –K6
K1: Remember K2: Understand K3: Apply K4: Analyze K5: Evaluate K6: Create		

Course Outline:

Unit – I

Tangent and Normal-Direction of the tangent-Angle of intersection of curves-subtangent and subnormal - Differential coefficient of the length of an arc of $y=f(x)$ - Polar coordinates - Angle between the radius vector and the tangent-Polar subtangent and polar subnormal - Length of arc in polar coordinates.

Unit – II

Method of finding the envelop - Curvature - Circle, radius and centre of curvature - Cartesian formulae - Evolute and Involute - Radius of curvature when the curve is given in polar coordinates.

Unit – III

Multiple integrals - Evaluation of double integrals - Double integral in polar coordinates - Triple integrals - Applications of multiple integrals.

Unit – IV

Infinite integrals - Integrand becoming infinite at certain points in the interval of integration - Beta and Gamma functions - Properties of Beta functions - Relation between Beta and Gamma functions - Evaluation of integrals using Gamma functions.

Unit – V

Differential equations: Standard types of first order and first degree equations. Variables separable, Homogeneous, Non-homogeneous equations and Linear equation. Equations of first order but of higher degree.

UNIT VI

Contemporary Issues: Expert lectures, online seminars – webinars. [2 hours]

BOOKS FOR STUDY:

1. Narayanan, S. and Manicavachagom Pillay, T.K. (2015) Calculus Vol. I, S.Viswanathan (Printers publishers) Pvt. Ltd., Chennai.
2. Narayanan, S. and Manicavachagom Pillay, T.K. (2014) Calculus Vol. II, S.Viswanathan (Printers publishers) Pvt. Ltd., Chennai.
3. Narayanan, S. and Manicavachagom Pillay, T.K. (2015) Calculus Vol. III, S.Viswanathan (Printers publishers) Pvt. Ltd., Chennai.

BOOKS FOR REFERENCE:

1. P.Duraipandian and S.Udayabaskaran,(1997) Allied Mathematics, Vol. I & II. Mihil Publishers, Chennai
2. S.P.Rajagopalan and R.Sattanathan,(2005) Allied Mathematics .Vol. I & II. Vikas Publications, New Delhi.
3. P.Kandasamy, K.Thilagavathy (2003) Allied Mathematics Vol-I, II S.Chand & company Ltd., New Delhi-55.

Mapping of Course Outcomes to Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	High	High	High	High	Medium	High	High
CO2	High	High	High	High	Medium	High	High
CO3	High	High	Medium	Medium	Low	High	High
CO4	High	High	High	Medium	Medium	High	High
CO5	High	Medium	Medium	High	Low	High	High
CO6	Medium	High	Medium	High	Low	High	High
Correlation Level: <i>LowMediumHigh</i>							

Mapping of Course Outcomes to Programme Specific Outcomes

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	Medium	High	High	High	Medium	High	High
CO2	Medium	High	High	High	High	High	High
CO3	Medium	High	High	High	High	Low	Medium
CO4	High	High	High	High	High	High	Medium
CO5	Medium	High	High	Medium	Medium	High	High
CO6	High	High	High	High	High	Low	High
Correlation Level: <i>LowMediumHigh</i>							

6. STATISTICS PRACTICAL – I

7. BASICS OF STATISTICS USING MS - EXCEL

Course Code	TITLE OF THE COURSE	L	T	P	C
Core	BASICS OF STATISTICS USING MS - EXCEL	2	0	0	2
Prerequisites	Knowledge of data basic Statistical tool	Syllabus Version		2024-25	

L: Lecture T: Tutorial P: Practical C: Credits

Course Objectives:

The main objectives of this course are to

- Understand the origin, significance and scope of Statistics.
- Know the significance of presenting data in the form of tables and diagrams.
- Learn computational aspects of basic statistical measures.

Course Outcomes (COs):

At the end of this course of study, the student will be able to

CO No.	Course Outcome	Cognitive Levels
CO1	Understand the scope and necessity of Statistics.	K1, K2
CO2	Able to obtain, tabulate and present the data in tables, diagrams and graphs.	K1-K3 and K5
CO3	Apply the formula and compute descriptive measures of statistics.	K2, K3
CO4	Learn to draw the statistical diagrams and analyze the data using Excel function.	K2, K4
CO5	Compute logical, statistical and mathematical functions	K2 and K3
CO6	Develop computer programs for carrying out computations related to this course	K1 –K6

K1: Remember**K2: Understand****K3: Apply****K4: Analyze****K5: Evaluate****K6: Create**

Course Outline:

UNIT - I

Nature and scope of Statistics - characteristics and limitations of Statistics - statistical investigation - preparation of questionnaire - Population and Sample - collection of data - primary and secondary data.

UNIT - II

Processing and presentation of data - Classification of data - tabulation of data - Formation of frequency tables - Diagrammatic presentation of statistical data - bar diagrams - pie diagrams and pictograms - simple problems - Graphical presentation of statistical data - Histogram, frequency curves - simple problems.

UNIT - III

Measures of Central tendency: Arithmetic Mean, Median, Mode. Measures of Dispersion: Range, Inter-Quartile Range, Standard Deviation and Coefficient of Variation.

UNIT - IV

Layout of MS-Excel window- The work book and work sheet-Elements of Worksheet: Row, Column, Cell- Cell reference: Relative and absolute – labels and names – range. Formula: Data types- Arithmetic operators – expression- text data-Alignment- Numerical value display. Formats- custom formats. File menu: New, Open, Save, Print worksheet - Edit Menu: Copy, Cut, Paste, Drag Drop – Insert, Delete cells- inserting rows and columns - Find and Replace.

UNIT - V

Logical functions : IF, AND, OR, NOT, TRUE and FALSE - Statistical Functions : AVERAGE, TRIMMEAN, MEDIAN, MODE, STDDEV, COUNT, MIN, MAX, FREQUENCY- Mathematical functions : ABS, CEILING, COS, COUNTIF, EXP, FACT, FLOOR, INT, LOG, MOD, ODD, PI, POWER, PRODUCT, QUOTIENT, RAND, ROUND, SINE, SIGN, SIN, SQRT, SUM, SUMIF, TAN, TRUNC.

UNIT - VI

Contemporary Issues: Expert lectures, online seminars – webinars. [2 hours]

BOOKS FOR STUDY:

1. Goon, A.M., Gupta, M.K. and Dasgupta, B. (2017): Fundamentals of Statistics, Volume-I, World Press Ltd, Calcutta.
2. Gupta, S.C. and V.K. Kapoor. (2020): Fundamentals of Mathematical Statistics, Sultan Chand and Sons, New Delhi.
3. Ananthi Sheshasayee and Sheshasayee, G, (2003), Computer Applications in Business and Management, Margham Publications, Chennai.

BOOKS FOR REFERENCE:

1. Robert, V. Hogg, Joseph W. McKean and Allen T. Craig (2013) Introduction to Mathematical Statistics (Seventh Edition), Pearson Education, New York.
2. Spiegel, M.R., Schiller, J. and Srinivasan, R.A. (2012): Probability and Statistics, Schaum's Outline Series (Fourth Edition). McGraw- Hill Publishing Company, New Delhi.
3. Singh, V. P. and Singh, M. (1998), MS-Excel, Megabyte Series, Asian Publishers, New Delhi.

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

1. <https://nptel.ac.in/courses/111/104/111104120>.
2. https://www.iiserpune.ac.in/~bhasapat/phy221_files/curvefitting.pdf.
3. <https://www.toppr.com/guides/maths/statistics/bar-graphs-and-histogram>.
4. <https://nptel.ac.in/courses/111/104/111104098>.

Mapping of Course Outcomes to Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	High	High	High	High	Medium	High	High
CO2	High	High	High	High	Medium	High	High
CO3	High	High	Medium	Medium	Low	High	High
CO4	High	High	High	Medium	Medium	High	High
CO5	High	Medium	Medium	High	Low	High	High
CO6	Medium	High	Medium	High	Low	High	High
Correlation Level:	LowMediumHigh						

Mapping of Course Outcomes to Programme Specific Outcomes

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	Medium	High	High	High	Medium	High	High
CO2	Medium	High	High	High	High	High	High
CO3	Medium	High	High	High	High	Low	Medium
CO4	High	High	High	High	High	High	Medium
CO5	Medium	High	High	Medium	Medium	High	High
CO6	High	High	High	High	High	Low	High
Correlation Level:	LowMediumHigh						

8. OFFICE AUTOMATION

Course Code	TITLE OF THE COURSE	L	T	P	C
Core	OFFICE AUTOMATION	2	0	0	2
Prerequisites	Basics of Computers	Syllabus Version		2024-25	

L: Lecture T: Tutorial P: Practical C: Credits

Course Objectives:

The main objectives of this course are to:

- Understanding Office Automation.
- Familiarity with Office Automation Tools.
- Efficient Use of Word Processing Software
- Mastering Spreadsheet Software

Course Outcomes (COs):

At the end of this course of study, the student will be able to

CO No.	Course Outcome	Cognitive Levels
CO1	Acquire the knowledge on Design text, pictures with MS-word and PowerPoint	K1
CO2	Understand the Windows Operating system	K2
CO3	Understand the printing and data results	K2
CO4	Compute statistical measures	K3
CO5	Learn to draw the statistical diagrams and analyze the data using Excel function.	K4
CO6	Develop computer programs for carrying out computations related to this course	K1 –K6
K1: Remember K2: Understand K3: Apply K4: Analyze K5: Evaluate K6: Create		

Course Outline:

UNIT - I

Introduction to Computer: Introduction - Types of computers - Characteristics of Computers. Generations of Computers: First Generation - Second Generation - Third Generation - Fourth Generation - Fifth Generation.

UNIT - II

Computer Software: Introduction - Operating System - Utilities - Compiler and Interpreters – Programming Languages: High level language - Types of High-Level Language. Input Devices: Output Devices.

UNIT - III

MS-Office: Text Manipulations - Usage of Numbering, Bullets, Footer and Headers - Usage of Spell check, Find & Replace - Text Formatting - Picture insertion and alignment - Creation of documents, using templates - Formatting a Table - Mail Merge Concepts.

UNIT - IV

MS-EXCEL: Cell Editing - Usage of Formulae and Built-in Functions - File Manipulations - Data Sorting (both number and alphabets) - Creating Graphs

UNIT - V

MS-POWER POINT: Inserting Clip arts and Pictures - Frame movements of Clip arts and Pictures - Insertion of new slides - Preparation of Organization Charts - Presentation using Wizards - Usage of design templates, Case Studies: Designing Advertisement and Document creation with special features like header, footer, tables, etc - PowerPoint presentation on various concepts

UNIT - VI

Contemporary Issues: Expert lectures, online seminars – webinars. [2 hours]

BOOKS FOR STUDY:

1. Alexis Leon and Mathews Leon, "Fundamentals of Computer Science and Communication Engineering", Leon Techworld, 1998.
2. Joyce Cox and Team, "Step by Step 2007 Microsoft Office System", PHI Learning Private limited, New Delhi, 2009.

BOOKS FOR REFERENCE:

1. B.Ram and Sanjay Kumar, "Computer Fundamentals", 5th Edition, New Age International Publishers, 2014.
2. Anita Goel, "Computer Fundamentals", 1st Edition, Pearson Education India, 2010.
3. Peter Weverka, "MS Office 2013 All-in-One for Dummies", 1st Edition, Wiley Publications, 2013.

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

1. <https://www.msuniv.ac.in/images/econtent/6.Computer%20%20Fundamentals%20and%20Office%20Automation.pdf>
2. <https://www.wileyindia.com/computer-basics-with-office-automation.html>
3. <https://support.microsoft.com/en-us/office/create-a-cross-reference-300b208c-e45a-487a-880ba02767d9774b>
4. <https://www.informit.com/articles/article.aspx?p=170392>

Mapping of Course Outcomes to Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	<i>High</i>	<i>High</i>	<i>High</i>	<i>High</i>	<i>Medium</i>	<i>High</i>	<i>High</i>
CO2	<i>High</i>	<i>High</i>	<i>High</i>	<i>High</i>	<i>Medium</i>	<i>High</i>	<i>High</i>
CO3	<i>High</i>	<i>High</i>	<i>Medium</i>	<i>Medium</i>	<i>Low</i>	<i>High</i>	<i>High</i>
CO4	<i>High</i>	<i>High</i>	<i>High</i>	<i>Medium</i>	<i>Medium</i>	<i>High</i>	<i>High</i>
CO5	<i>High</i>	<i>Medium</i>	<i>Medium</i>	<i>High</i>	<i>Low</i>	<i>High</i>	<i>High</i>
CO6	<i>Medium</i>	<i>High</i>	<i>Medium</i>	<i>High</i>	<i>Low</i>	<i>High</i>	<i>High</i>
Correlation Level: <i>LowMediumHigh</i>							

Mapping of Course Outcomes to Programme Specific Outcomes

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	<i>Medium</i>	<i>High</i>	<i>High</i>	<i>High</i>	<i>Medium</i>	<i>High</i>	<i>High</i>
CO2	<i>Medium</i>	<i>High</i>	<i>High</i>	<i>High</i>	<i>High</i>	<i>High</i>	<i>High</i>
CO3	<i>Medium</i>	<i>High</i>	<i>High</i>	<i>High</i>	<i>High</i>	<i>Low</i>	<i>Medium</i>
CO4	<i>High</i>	<i>High</i>	<i>High</i>	<i>High</i>	<i>High</i>	<i>High</i>	<i>Medium</i>
CO5	<i>Medium</i>	<i>High</i>	<i>High</i>	<i>Medium</i>	<i>Medium</i>	<i>High</i>	<i>High</i>
CO6	<i>High</i>	<i>High</i>	<i>High</i>	<i>High</i>	<i>High</i>	<i>Low</i>	<i>High</i>
Correlation Level: <i>LowMediumHigh</i>							

SEMESTER – II

9. TAMIL

10. ENGLISH

11. MATRIX AND LINEAR ALGEBRA

Course Code	TITLE OF THE COURSE	L	T	P	C
Core	MATRIX AND LINEAR ALGEBRA	3	0	1	4
Prerequisites	Knowledge of Algebra, vector and Arithmetic Operation	Syllabus Version		2024-25	

L: Lecture T: Tutorial P: Practical C: Credits

Course Objectives:

The main objectives of this course are to

- To study the basic operations of transpose and inverse of matrices
- To know the structure of orthogonal and unitary matrices
- To learn the invariance properties of ranks
- To know and to apply the concepts of vector space and matrix polynomials.

Course Outcomes (COs):

At the end of this course of study, the student will be able to

CO No.	Course Outcome	Cognitive Levels
CO1	Understand the scope and necessity of Matrices.	K1, K2
CO2	Able to obtain transpose of matrix, inverse and conjugate of matrix	K1-K3 and K5
CO3	Apply the formula and compute Rank of a matrix	K2, K3
CO4	Analyze and study the properties of matrices using Ranks	K3, K4
CO5	Analyze the properties of Matrix polynomials, Characteristic roots	K3, K5
CO6	Develop computer programs for carrying out computations related to this course	K1 –K6

K1: Remember K2: Understand K3: Apply K4: Analyze K5: Evaluate K6: Create

Course Outline:

UNIT - I

Matrices-Transpose-Conjugate transpose- Reversal law for the transpose and conjugate transpose. Adjoint of a matrix, Inverse of a matrix, Singular and Non -Singular matrices.

UNIT - II

Reversal law for the inverse of product of two matrices. Commutativity of inverse and transpose of matrix, Commutativity of inverse and conjugate transpose of matrix, Orthogonal and Unitary Matrices, Product of unitary matrices, Partitioning of matrices.

UNIT - III

Rank of a matrix, Echelon form, Rank of transpose, Elementary transformations, Elementary matrices, Invariance of rank through elementary transformations, Reduction to Normal form, Equivalent matrices.

UNIT - IV

Vector space – Linear Dependence - Basis of a vector space –Sub-space - Properties of Linearly Independent and Dependent systems, Row and Column spaces, Equality of Row and Column ranks, Rank of Sum and Product of matrices

UNIT - V

Matrix polynomials, Characteristic roots and vectors, Relation between characteristic roots and characteristic vectors, Algebraic and Geometric multiplicity, Nature of characteristic roots in case of special matrices, Cayley- Hamilton theorem.

UNIT - VI

Contemporary Issues: Expert lectures, online seminars – webinars. [2 hours]

BOOKS FOR STUDY:

1. Vasishtha, A.R. (2014) Matrices, Krishna Prakashan, Meerut.
2. Shanthi Narayan. and Mittal, P.K. (2000) A Text Book of Matrices, S.Chand & Co, New Delhi.

BOOKS FOR REFERENCE:

1. Narayanan and T. K. Manickavachagam Pillai – Ancillary Mathematics, Vol. II, S. Viswanathan Pvt. Ltd, Chennai.
2. Gentle, J.E. (2007) Matrix Algebra Theory, Computations, and Applications in Statistics, Springer, New York.
3. Richard Bronson. (2011) Matrix Operations, Schaum's Outline Series, McGraw Hill, New York.
4. Searle, S. R. (2006) Matrix Algebra useful for Statistics, Wiley Interscience, New York.
5. M.L. Khanna (2009), Matrices, Jai Prakash Nath & Co.

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

1. e-books, tutorials on MOOC/SWAYAM courses on the subject
2. <https://samples.jbpub.com/9781556229114/chapter7.pdf>
3. <https://www.vedantu.com/maths/matrix-rank>
4. <https://textbooks.math.gatech.edu/ila/characteristic-polynomial.html>
5. <https://www.aitude.com/explain-echelon-form-of-a-matrix/>

Mapping of Course Outcomes to Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	High	High	Medium	Medium	Medium	High	Medium
CO2	High	High	High	High	Medium	High	Medium
CO3	High	High	Medium	Medium	Low	High	Medium
CO4	High	High	High	Medium	Medium	High	High
CO5	High	Medium	Medium	High	Low	High	High
CO6	Medium	High	Medium	High	Low	High	High
Correlation Level: LowMediumHigh							

Mapping of Course Outcomes to Programme Specific Outcomes

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	Medium	High	High	High	Medium	High	High
CO2	High	High	High	High	High	High	High
CO3	Medium	Medium	High	High	High	Low	Medium
CO4	High	Medium	High	High	Medium	High	Medium
CO5	Medium	High	High	Medium	Medium	High	High
CO6	High	High	High	High	High	Medium	High
Correlation Level: LowMediumHigh							

12. DISTRIBUTIONS THEORY

Course Code	TITLE OF THE COURSE	L	T	P	C
Core	DISTRIBUTIONS THEORY	3	0	1	4
Prerequisites	Knowledge of Probability Theory and Distributions	Syllabus Version		2024-25	

L: Lecture T: Tutorial P: Practical C: Credits

Course Objectives:

The main objectives of this course are to

- Facilitate for acquiring knowledge on theoretical aspects of probability distributions
- Understand relationships among statistical distributions
- Inculcate the ability for carrying out statistical analysis of probability distributions.

Course Outcomes (COs):

At the end of this course of study, the student will be able to

CO No.	Course Outcome	Cognitive Level
CO1	Compute marginal and conditional distributions from joint distributions	K1 – K3
CO2	Describe the properties of univariate discrete distributions	K1, K6
CO3	Understand the properties of continuous distributions	K3, K5
CO4	Analyze the properties of univariate continuous distributions and bivariate normal distribution	K4
CO5	Derive the sampling distributions related to Normal distribution and to study their properties	K1, K6
CO6	Develop computer programs for carrying out computations related to this course	K1 – K6

K1: Remember K2: Understand K3: Apply K4: Analyze K5: Evaluate K6: Create

Course Outline:

Unit - I

Distributions of functions of one-dimensional and two-dimensional random variables – Distribution function method, Transformations and Moment generating function method.

Unit - II

Discrete distributions: Bernoulli, Binomial, Poisson, Geometric and Negative binomial distributions - Multinomial distribution. Moments – probability generating function, moment generating function, characteristic function and properties.

Unit - III

Continuous distributions: Uniform, Normal, Cauchy and Lognormal distributions - concepts, moments, moment generating function, characteristic function and properties.

Unit - IV

Exponential, Gamma, Beta (first and second kinds) concepts, moments, moment generating function, characteristic function and properties.

Unit - V

Sampling distributions: *Chi*-square, *t* and *F* distributions- concepts, moments, moment generating function, characteristic function and properties.

UNIT VI

Contemporary Issues: Expert lectures, online seminars – webinars. [2 hours]

BOOKS FOR STUDY:

1. Goon, A. M., M.K. Gupta, and B. Dasgupta (2002) Fundamentals of Statistics, Vol. I, (Third Edition), World Press Ltd, Kolkata.
2. Alexander, M. Mood, Franklin A. Graybill and Duane C. Boes (2017). Introduction to the Theory of Statistics (Third Edition), Mc Graw Hill Education, New Delhi.

BOOKS FOR REFERENCE:

1. Bhuyan K.C. (2010), Probability Distribution Theory and Statistical Inference, New Central Book Agency (P) Ltd., New Delhi.
2. Gupta, S. C., and V. K. Kapoor (2020) Fundamentals of Mathematical Statistics, (Twelfth Edition). Sultan Chand & Sons, New Delhi.
3. Robert, V. Hogg, Joseph W. McKean and Allen T. Craig (2013) Introduction to Mathematical Statistics (Seventh Edition), Pearson Education, New York.
4. Rohatgi, V. K. and A. K. Md. E. Saleh (2009). An Introduction to Probability Theory and Mathematical Statistics (Second Edition). John Wiley & Sons, New York.

Related Online MOOCs Contents [SWAYAM, NPTEL, Websites etc.]

1. https://swayam.gov.in/nd2_cec20_ma01/preview
2. <https://nptel.ac.in/courses/111/104/111104032/>

Mapping of Course Outcomes to Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	Medium	High	High	High	Medium	High	High
CO2	High	High	High	High	High	High	High
CO3	High	High	Medium	Medium	Medium	High	High
CO4	High	High	High	Medium	High	High	High
CO5	High	High	Medium	High	Low	High	High
CO6	High	High	High	High	High	High	High
Correlation Level: LowMediumHigh							

Mapping of Course Outcomes to Programme Specific Outcomes

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	Medium	High	High	High	Medium	High	Medium
CO2	Medium	High	High	Medium	High	High	High
CO3	High	High	High	High	High	High	Medium
CO4	High	High	High	High	High	High	Medium
CO5	High	Medium	High	Medium	Medium	High	High
CO6	High	High	High	High	High	Low	High
Correlation Level: LowMediumHigh							

13. REAL ANALYSIS

Course Code	TITLE OF THE COURSE	L	T	P	C
Core	REAL ANALYSIS	4	0	0	3
Prerequisites	Knowledge of multivariate calculus and linear algebra and basic set theory	Syllabus Version		2024-25	

L: Lecture T: Tutorial P: Practical C: Credits

Course Objectives:

The main objectives of this course are to

- To study the basic operations of sets and functions
- To know the structure of the real sequence and its convergence
- To learn series and its convergence
- To learn the limits, continuity and derivative of real valued functions
- To know and to apply the Riemann integration

Course Outcomes (COs):

At the end of this course of study, the student will be able to

CO No.	Course Outcome	Cognitive Level
CO1	Do basic operations of sets and understand set functions	K1
CO2	Understand sequence and its convergence	K1,K2
CO3	Understand series and its convergence	K2
CO4	Identify real valued functions and its discontinuity	K3-K5
CO5	Understand integration concepts	K4
CO6	Understand probability functions as set functions and get knowledge on discrete and continuous nature of it	K2

K1: Remember K2: Understand K3: Apply K4: Analyze K5: Evaluate K6: Create

Course Outline:

Unit - I

Operations on sets, Functions, Real valued functions, Equivalence, Countability, Real Numbers, Cantor set, Least Upper Bounds, Greatest Lower Bound.

Unit - II

Definition of Sequence, Subsequence, Limit of a sequence, Convergent and Divergent sequences, Oscillating sequence, Bounded and Monotone sequences, Operations on convergent sequences, Limit Infimum, Limit Supremum, Cauchy sequences, Summability of sequences.

Unit - III

Definition of Series, Convergent and Divergent series, series with nonnegative terms, alternating series, conditional convergence, absolute convergences and test for absolute convergence

Unit - IV

Limit of a function on the real line, Increasing and Decreasing functions, Continuous function, Operations on continuous functions, Composition of continuous functions, Derivatives, Derivative and continuity, Rolle's Theorem, Mean value theorem, Taylor's theorem

Unit - V

Concept of Riemann Integral, Refinement of partition, Upper and Lower sums, Upper integral and Lower Integral Riemann integrability, Necessary and Sufficient condition for Riemann integrable, Properties of Riemann integrals, Fundamental theorem

UNIT - VI

Contemporary Issues: Expert lectures, online seminars – webinars. [2 hours]

BOOKS FOR STUDY:

1. Goldberg. R R(1976) : Methods of Real Analysis, Oxford &IBH.
2. Ranjit Singh and Arora, First course in Real Analysis, Sultan Chand, 1974.
3. Narayanan and Manickavasagam pillai, Ancillary Mathematics, 2009.

BOOKS FOR REFERENCE:

1. Shanthinarayan, (2012): Real Analysis, S. Chand & Co, New Delhi
2. Walter Rudin (2017), Principles of Mathematical Analysis, 3rd Edition, McGraw-Hill

Related Online MOOCs Contents [SWAYAM, NPTEL, Websites etc.]

1. <https://tutorial.math.lamar.edu/classes/calci/thelimit.aspx>
2. <https://www.mathsisfun.com/calculus/derivatives-introduction.html>
3. <https://www.math.ucdavis.edu/~hunter/m125b/ch1.pdf>
4. <https://math.hmc.edu/calculus/hmc-mathematics-calculus-online-tutorials/single-variable-calculus/taylors-theorem/>
5. <http://www.ms.uky.edu/~droyster/courses/fall06/PDFs/Chapter06.pdf>

Mapping of Course Outcomes to Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	High	High	High	Medium	High	High	Medium
CO2	High	High	High	Medium	High	High	High
CO3	High	High	Medium	Medium	Medium	High	Medium
CO4	High	High	High	Medium	High	High	High
CO5	High	High	Medium	High	Low	High	High
CO6	High	Medium	Medium	High	Medium	High	Medium
Correlation Level: LowMediumHigh							

Mapping of Course Outcomes to Programme Specific Outcomes

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	Medium	High	High	High	Medium	High	Medium
CO2	Medium	High	High	Medium	High	High	High
CO3	High	High	High	High	High	High	Medium
CO4	High	High	High	High	High	High	Medium
CO5	High	Medium	High	Medium	Medium	High	High
CO6	High	High	High	High	High	Low	High
Correlation Level: LowMediumHigh							

14. STATISTICS PRACTICAL – II

15. MATHEMATICS FOR STATISTICS - II

Course Code	TITLE OF THE COURSE	L	T	P	C
Core	MATHEMATICS FOR STATISTICS-II	2	0	0	1
Prerequisites	Basic knowledge of theory of equations and Calculus	Syllabus Version		2024-25	

L: Lecture T: Tutorial P: Practical C: Credits

Course Objectives:

The main objectives of this course are to

- Inculcate and understand the mathematical concepts in calculus.
- Improve problem-solving and analytical skills in differentiation and integration.
- Explore and analyze the concepts of functions using derivatives and integrals.
- Familiarize with the properties of differentiation and integration.
- Apply the appropriate techniques in calculus to solve statistical problems.
- Enhance the ability of solving problems related to maxima and minima.

Course Outcomes (COs):

At the end of this course of study, the student will be able to

CO No.	Course Outcome	Cognitive Levels
CO1	Understand solving Algebraic and differential equations of different kind applying suitable methods	K1, K2
CO2	Develop competency in applying the ideas of derivatives, partial derivatives and integration	K3
CO3	Obtain the maxima and minima for algebraic functions and solutions for integration with appropriate techniques.	K6
CO4	Evaluate homogeneous linear differentiation.	K5
CO5	Evaluate Laplace transformation.	K6
CO6	Develop computer programs for carrying out computations related to this course	K1 –K6
K1: Remember K2: Understand K3: Apply K4: Analyze K5: Evaluate K6: Create		

Course Outline:

Unit - I

Theory of Equations: Nature of roots, Formulation of equation whose roots are given. Relation between coefficients and roots - Transformation of equations.

Unit - II

Successive differentiation – Trigonometrical transformations - Leibnitz's Formulas, nth derivative of standard functions - simple problems. Partial differentiation – Successive partial differentiation.

Unit - III

Maxima and Minima for one variable – Applications – Concavity, Convexity and points of inflexion - working rule.

Unit – IV

Linear differential equations of second order with constant coefficients - $(aD^2+bD+c)y = X$, various forms of $X : e^{ax}$, $\cos ax$, $\sin ax$, x^m . Methods of solving homogeneous linear differential equations of second order.

Unit – V

Laplace transform and its inverse – solving ordinary differential equation with constant coefficient using Laplace transform.

UNIT - VI

Contemporary Issues: Expert lectures, online seminars – webinars. [2 hours]

BOOKS FOR STUDY:

1. Narayanan,S., Hanumantha Rao and T.K. Manicavachagom Pillay (2008) Ancillary Mathematics, Volume I, S. Viswanathan Pvt. Ltd, Chennai.
2. Narayanan, S. and T.K. Manicavachagom Pillay (2015) Calculus Vol. I, II and III, S. Viswanathan Pvt. Ltd, Chennai.

BOOKS FOR REFERENCE:

1. P.Kandasamy, K.Thilagavathy (2003) Allied Mathematics Vol-I, II S.Chand & company Ltd., New Delhi-55.
2. P.Duraipandian and S.Udayabaskaran,(1997) Allied Mathematics, Vol. I & II. Muhil Publishers, Chennai
3. S.P.Rajagopalan and R.Sattanathan,(2005) Allied Mathematics .Vol. I & II. Vikas Publications, New Delhi.

Related Online MOOCs Contents [SWAYAM, NPTEL, Websites etc.]

1. <https://www.youtube.com/watch?v=-OITic9HeUQ>
2. https://mathinsight.org/integration_applications
3. <https://ocw.mit.edu/ans7870/resources/Strang/Edited/Calculus/Calculus.pdf>
4. https://www.sac.edu/FacultyStaff/HomePages/MajidKashi/PDF/MATH_150/Bus_Calculus.pdf

Mapping of Course Outcomes to Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	High	High	High	High	Medium	High	High
CO2	High	High	High	High	Medium	High	High
CO3	High	High	Medium	Medium	Low	High	High
CO4	High	High	High	Medium	Medium	High	High
CO5	High	Medium	Medium	High	Low	High	High
CO6	Medium	High	Medium	High	Low	High	High
Correlation Level: LowMediumHigh							

Mapping of Course Outcomes to Programme Specific Outcomes

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	Medium	High	High	High	Medium	High	High
CO2	Medium	High	High	High	High	High	High
CO3	Medium	High	High	High	High	Low	Medium
CO4	High	High	High	High	High	High	Medium
CO5	Medium	High	High	Medium	Medium	High	High
CO6	High	High	High	High	High	Low	High
Correlation Level: LowMediumHigh							

16. PROGRAMMING IN C++

Course Code	TITLE OF THE COURSE	L	T	P	C
Core	PROGRAMMING IN C++	2	0	0	1
Prerequisites	Basic knowledge Office Automation	Syllabus Version		2024-25	

L: Lecture T: Tutorial P: Practical C: Credits

Course Objectives:

The main objectives of this course are to

- To learn the concepts of class & objects.
- To inculcate knowledge on Object-oriented programming concepts using C++.
- To gain Knowledge on programming with C++.
- To perform Inheritance, Overloading of operators, functions, constructors, File Handling and exception handling.

Course Outcomes (COs):

At the end of this course of study, the student will be able to

CO No.	Course Outcome	Cognitive Levels
CO1	Define and understand the basic concepts in C++ Programming.	K1
CO2	Explain and execute C++ programs to explore the concepts of classes and objects.	K2
CO3	Apply the skills to write the C++ code using constructors and operator overloading.	K3
CO4	Analyze the concepts of OOPS such as Inheritance, Virtual base classes and Abstract classes	K4
CO5	Discover the concept of streams, file management, Template and Exception handling in C++	K5
K1: Remember K2: Understand K3: Apply K4: Analyze K5: Evaluate K6: Create		

Course Outline:

Unit – I

Introduction to C++ - key concepts of Object-Oriented Programming –Advantages – Object Oriented Languages –vI/O in C++ - C++ Declarations. Control Structures : - Decision Making and Statements : If ..else, jump, goto,vbreak, continue, Switch case statements - Loops in C++ : for, while, do - functions in C++ - inline functions – Function Overloading.

Unit - II

Classes and Objects: Declaring Objects – Defining Member Functions – Static Member variables and functions – array of objects –friend functions – Overloading member functions – Bit fields and classes – Constructor and destructor with static members.

Unit – III

Operator Overloading: Overloading unary, binary operators – Overloading Friend functions – type conversion – Inheritance: Types of Inheritance – Single, Multilevel, Multiple, Hierarchal, Hybrid, Multi path inheritance – Virtual base Classes – Abstract Classes.

Unit – IV

Pointers – Declaration – Pointer to Class , Object – this pointer – Pointers to derived classes and Base classes – Arrays – Characteristics – array of classes – Memory models – new and delete operators – dynamic object – Binding, Polymorphism and Virtual Functions.

Unit – V

Files – File stream classes – file modes – Sequential Read / Write operations – Binary and ASCII Files – Random Access Operation – Templates – Exception Handling - String – Declaring and Initializing string objects – String Attributes – Miscellaneous functions .

UNIT – VI

Contemporary Issues: Expert lectures, online seminars – webinars.

[2 hours]

BOOKS FOR STUDY:

1. Kernighan, B.W. and Ritchie, D. (1988): C Programming Language, 2nd Edition, Prentice Hall.
2. Balagurusamy, E. (2011): Programming in ANSI C, 6th Edition, Tata McGraw Hill.
3. Gottfried, B.S. (1998): Schaum's Outlines: Programming with C, 2nd Edition, Tata McGraw Hill

BOOKS FOR REFERENCE:

1. E. Balagurusamy, "Object-Oriented Programming with C++", TMH 2013, 7th Edition.
2. The C++ programming language, Bjarne Stroustrup, Pearson publications.
3. Object Oriented Programming in C++ by N.Barkakati, PHI.
4. Herbert Schildt (2003), "C++: The Complete Reference", Tata McGraw publication.

Related Online MOOCs Contents [SWAYAM, NPTEL, Websites etc.]

1. https://onlinecourses.nptel.ac.in/noc20_cs07/preview
2. https://onlinecourses.nptel.ac.in/noc20_cs91/preview
3. https://onlinecourses.nptel.ac.in/noc22_cs103/preview
4. https://onlinecourses.nptel.ac.in/noc23_cs121/preview

Mapping of Course Outcomes to Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	High	High	Medium	High	Medium	High	High
CO2	High	Medium	High	High	Medium	High	High
CO3	High	High	Medium	Medium	Low	High	Medium
CO4	High	Medium	High	Medium	Medium	High	High
CO5	High	Medium	Medium	High	Medium	High	Medium
CO6	Medium	High	Medium	High	Medium	High	High
Correlation Level: LowMediumHigh							

Mapping of Course Outcomes to Programme Specific Outcomes

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
C01	Medium	High	High	High	Medium	High	High
C02	High	High	Medium	High	High	High	High
C03	Medium	Medium	High	High	Medium	Medium	Medium
C04	High	High	High	High	High	High	Medium
C05	High	Medium	High	Medium	Medium	High	High
C06	High	High	High	High	High	Medium	High
Correlation Level: LowMediumHigh							

17. NAAN MUDHALVAN

SEMESTER – III

18. TAMIL

19. ENGLISH

20. ESTIMATION THEORY

Course code	TITLE OF THE COURSE	L	T	P	C
Core	ESTIMATION THEORY	4	0	0	4
Prerequisites	Knowledge of Real Analysis, Probability Theory and Distribution Theory	Syllabus Version		2024-25	

L: Lecture T: Tutorial P: Practical C: Credits

Course Objectives:

The main objectives of this course are to

- Facilitate for investigating the properties of point estimators
- Impart the application of various methods of finding point estimators
- Inculcate construction of confidence intervals.

Course Outcomes (COs):

At the end of this course of study, the student will be able to

CO No.	Course Outcome	Cognitive Level
CO1	Evaluate the properties of point estimators	K1 & K2
CO2	Compute minimum variance bound and to determine minimum variance unbiased estimator	K1 - K3
CO3	Find point estimators employing the frequentist and Bayesian approaches	K1 - K3
CO4	Determine the asymptotic behavior of point estimators	K3 & K4
CO5	Construct confidence intervals for various parametric functions	K1, K3 & K6
CO6	Develop computer programs for carrying out computations related to this course	K1 – K6

K1: Remember K2: Understand K3: Apply K4: Analyze K5: Evaluate K6: Create

Course Outline:

Unit - I

Statistical Inference: meaning and purpose, parameter and statistic. Sampling distribution and standard error. Estimator and estimate. Point Estimation: consistency, unbiasedness, efficiency and sufficient statistic - Neyman's factorization theorem (without proof) - simple problems.

Unit - II

Unbiased Estimation: Minimum variance unbiased estimator - Cramer-Rao Inequality and Rao-Blackwell theorem - applications and simple problems.

Unit - III

Methods of estimation: Method of moments and Method of maximum likelihood. Properties of estimators obtained by these methods. Method of least squares for regression models. Asymptotic properties of maximum likelihood estimators (without proof).

Unit - IV

Interval estimation: Interval estimator, confidence coefficient, confidence limits, pivotal quantity. Interval estimation for proportions, mean(s), variance(s) based on *Chi* - square, Student's *t*, *F* and normal distributions – simple problems.

Unit - V

Bayes estimation: concepts of prior, posterior and conjugate prior. Loss function: 0-1 loss function and quadratic error loss function. Bayes estimator. Simple problems involving quadratic error loss function.

UNIT VI

Contemporary issues: Experts' lectures – online seminars and webinars. [2 hours]

BOOKS FOR STUDY:

1. Goon, A. M., M.K. Gupta, and B. Dasgupta (2002) Fundamentals of Statistics, Vol. I, (Third Edition), World press Ltd, Kolkata.
2. Alexander, M. Mood, Franklin A. Graybill and Duane C. Boes (2017). Introduction to the Theory of Statistics (Third Edition), Mc Graw Hill Education, New Delhi.

BOOKS FOR REFERENCE:

1. Bhuyan K.C. (2010), Probability Distribution Theory and Statistical Inference, New Central Book Agency (P) Ltd., New Delhi.
2. Gupta, S. C., and V. K. Kapoor (2020) Fundamentals of Mathematical Statistics, (Twelfth Edition). Sultan Chand & Sons, New Delhi.
3. Robert, V. Hogg, Joseph W. McKean and Allen T. Craig (2013) Introduction to Mathematical Statistics (Seventh Edition), Pearson Education, New York.
4. Rohatgi, V. K. and A. K. Md. E. Saleh (2009). An Introduction to Probability Theory and Mathematical Statistics (Second Edition). John Wiley & Sons, New York.

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

1. <https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=+u3y6UdbIvOJ97LFeSCmHQ=P-04>. Statistical Inference (38).

2. [https://nptel.ac.in/courses/111105043/Statistical Inference-IIT Kharagpur](https://nptel.ac.in/courses/111105043/Statistical%20Inference-IIT%20Kharagpur).
3. [https://nptel.ac.in/courses/111105124/Statistical Inference-IIT Kharagpur](https://nptel.ac.in/courses/111105124/Statistical%20Inference-IIT%20Kharagpur)

MSU

Mapping of Course Outcomes to Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	High	Medium	Medium	High	Medium	Medium	High
CO2	High	Medium	Medium	High	Low	High	High
CO3	High	High	High	High	Medium	High	High
CO4	High	Medium	Medium	Medium	High	Medium	High
CO5	High	High	High	Medium	High	Medium	High
CO6	High	High	High	High	Medium	High	High
Correlation Level: LowMediumHigh							

Mapping of Course Outcomes to Programme Specific Outcomes

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	High	High	High	Medium	High	High	High
CO2	Medium	Medium	High	Low	High	High	High
CO3	High	High	High	Medium	High	High	High
CO4	High	High	Medium	Medium	Medium	High	High
CO5	High	Medium	High	High	Low	Medium	High
CO6	Medium	High	High	Medium	Low	High	High
Correlation Level: LowMediumHigh							

21. SAMPLING TECHNIQUES

Course Code	TITLE OF THE COURSE	L	T	P	C
Core	SAMPLING TECHNIQUES	4	0	0	4
Prerequisites	Basic notions of sampling methods, Probability computation, Descriptive Statistics	Syllabus Version		2024-25	

L: Lecture T: Tutorial P: Practical C: Credits

Course Objectives:

The main objectives of this course are to

- Introduce sampling techniques, which are used for drawing random samples from finite population.
- Develop skill to compute estimators their sampling errors and to provide knowledge for conducting field surveys.
- Study the properties of estimators related to various sampling methods.

MSU

Course Outcomes (COs):

At the end of this course of study, the student will be able to

CO No.	Course Outcome	Cognitive Level
CO1	Understand the principles of sampling as a means of making inferences about a population	K1 – K3
CO2	Understand the difference between randomization theory and model-based analysis	K1, K6
CO3	Understand the concepts of bias and sampling variability and strategies for reducing these,	K3, K5
CO4	Conduct sample surveys and analyze the data	K4
CO5	Address the practical issues arising in sampling studies.	K1, K6
CO6	Develop computer programs for carrying out computations related to this course	K1 – K6

K1: Remember**K2: Understand****K3: Apply****K4: Analyze****K5: Evaluate****K6: Create**

Course Outline:

Unit-I

Population, Census method - Need for sampling - Basic concepts of sample surveys - sampling unit - sampling frame - Principal steps involved in sample surveys - Preparation of schedules and questionnaires.

Unit-II

Sampling errors - Bias and standard errors - Mean squared error - Determination of sample size with reference to sampling errors. Non-sampling errors, Sources and types of non-sampling errors - non-response and response errors.

Unit-III

Simple random sampling with and without replacement (Lottery method and random number table) - estimation of population parameters - mean, variance and proportion - Simple random sampling for attributes; confidence limits - Determination of sample size.

Unit-IV

Stratified random sampling-principles of stratification - Estimation of population mean and its variance - Allocation techniques (equal allocation, proportional allocation, Neyman allocation and optimum allocation) - Estimation of gain due to stratification.

Unit-V

Systematic sampling - Estimation of population mean and its variance - Comparison of simple random, stratified random and systematic sampling.

UNIT - VI

Contemporary Issues: Expert lectures, online seminars – webinars. [2 hours]

BOOKS FOR STUDY:

1. William G. Cochran (1990) Sampling Techniques (Third Edition), John Wiley Sons, New York.

2. Sampath, S. (2006) Sampling Theory and Methods (Second Edition), Narosa Publishing House, New Delhi.
3. Gupta, S.C., and Kapoor, V.K., (2007). Fundamentals of Applied Statistics, Sultan Chand & Sons, New Delhi.

BOOKS FOR REFERENCE:

1. Daroga Singh and Choudary, F.S.(1986) Theory and Analysis of Sample Survey Designs, New age International publishers, New Delhi.
2. Des Raj and Promod Chandhok (1998) Sample Survey Theory, Narosa Publishing House Pvt. Ltd, New Delhi.
3. Murthy, M.N. (1977) Sampling Theory and Statistical Methods, Statistical Publishing Society, Kolkata.

Related Online MOOCs Contents [SWAYAM, NPTEL, Websites etc.]

1. <http://home.iitk.ac.in/~shalab/course432.htm>
2. <https://nptel.ac.in/courses/111/104/111104073/>
3. <https://nptel.ac.in/content/storage2/courses/111104073/Module14/Lecture42.pdf>
4. <https://www.mooc-list.com/tags/sampling-methods>

Mapping of Course Outcomes to Programme Outcomes

	P01	P02	P03	P04	P05	P06	P07
C01	High	Medium	High	Low	High	High	High
C02	High	Medium	High	Low	High	High	High
C03	High	High	Low	Medium	High	High	High
C04	High	High	Medium	Medium	High	High	High
C05	High	Medium	Medium	Medium	High	High	High
C06	Medium	High	High	Medium	High	High	Medium
Correlation Levels: LowMediumHigh							

Mapping of Course Outcomes to Programme Specific Outcomes

	PS01	PS02	PS03	PS04	PS05	PS06	PS07
C01	Medium	Medium	High	High	High	High	High
C02	Medium	High	Low	High	Low	High	High
C03	Medium	High	High	Medium	Medium	High	Medium
C04	High	High	High	High	Medium	High	High
C05	High	High	Medium	Low	High	High	High
C06	High	High	High	High	High	Low	High
Correlation Levels: LowMediumHigh							

22. NUMERICAL METHODS

Course Code	TITLE OF THE COURSE	L	T	P	C
Core	NUMERICAL METHODS	4	0	0	4
Prerequisites	Basics of Differentiation and integration	Syllabus Version		2024-25	

L: Lecture T: Tutorial P: Practical C: Credits

Course Objectives:

The main objectives of this course are to

- Convert a system of linear equations into matrix form and acquire knowledge to solve them using Gauss elimination and Gauss-Seidel methods.
- Obtain approximate solutions to the functions using iterative methods.
- Utilize various interpolation techniques of discrete data in real life situations.
- Evaluate numerical calculations of problems in differentiation and integration.

Course Outcomes (COs):

At the end of this course of study, the student will be able to

CO No.	Course Outcome	Cognitive Levels
CO1	Understand various concepts in numerical methods.	K1, K2
CO2	Apply different techniques for finding solutions to intractable mathematical problems.	K3
CO3	Solve algebraic and transcendental equations applying different techniques.	K4
CO4	Interpolate the values for given data applying different forward and backward operators.	K5
CO5	Carry out numerical differentiation and Integration of functions from given data.	K6
CO6	Develop computer programs for carrying out computations related to this course	K1 –K6
K1: Remember K2: Understand K3: Apply K4: Analyze K5: Evaluate K6: Create		

Course Outline:

Unit - I

Solving algebraic equations: Bisection method, False position method, Newton - Raphson method. Simple problems and applications.

Unit - II

Gauss Elimination method, Gauss – Jordan, Gauss –Jacobi and Gauss- Seidel methods. Solving system of linear equations using Cramer’s rule and inverse of matrix. Simple problems and applications.

Unit - III

Operators and differences: Operators – E , Δ , δ and ∇ - their relationship and their role in different tables.

Interpolation: Solving problems for equidistant cases using Newton’s forward and backward difference formulae. Lagrange’s formula and Newton’s divided difference formula for unequal intervals. Simple problems and applications.

Unit - IV

Numerical differentiation – Newton’s forward and backward formulae – maxima and minima using numerical methods.

Unit - V

Numerical Integration: Quadrature rule- trapezoidal rule - Simpson’s one - third rule and three-eighth rule – Gregory Formula, Newton – Cote’s formula.

UNIT - VI

Contemporary issues: Experts’ lectures – online seminars and webinars. [2 hours]

BOOKS FOR STUDY:

1. Sastry, S. S. (2012). Introductory Methods of Numerical Analysis (Fifth Edition). Prentice Hall of India, New Delhi.
2. Jain, M. K., S. R. K. Iyengar and R.K. Jain (2019). Numerical Methods for Scientific and Engineering Computation (Seventh Edition). New Age International (P) Ltd., New Delhi.

BOOKS FOR REFERENCE:

1. Atkinson, K. (2003). Elementary Numerical Analysis (Third Edition). John Wiley & Sons, New York.
2. Gerald, C. F. and P. O. Wheatley (2004) Applied Numerical Analysis (Seventh Edition). Pearson, New York.
3. James B. Scarborough, (2010). Numerical Mathematical Analysis (Sixth Edition). Oxford & IBH Publishing Co., New Delhi.

Related Online MOOCs Contents [SWAYAM, NPTEL, Websites etc.]

1. https://books.google.co.in/books?id=anwHfrXY8_wC&printsec=frontcover#v=onepage&q&f=false.
2. <https://numericalmethodstutorials.readthedocs.io/en/latest>.
3. Elementary Numerical Analysis: An Algorithmic Approach by Samuel Daniel Conte (e-book).

Mapping of Course Outcomes to Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	<i>High</i>	<i>Medium</i>	<i>High</i>	<i>High</i>	<i>Low</i>	<i>High</i>	<i>High</i>
CO2	<i>High</i>	<i>Medium</i>	<i>Medium</i>	<i>High</i>	<i>Low</i>	<i>High</i>	<i>High</i>
CO3	<i>High</i>	<i>Medium</i>	<i>Medium</i>	<i>High</i>	<i>Medium</i>	<i>High</i>	<i>High</i>
CO4	<i>High</i>	<i>High</i>	<i>High</i>	<i>Medium</i>	<i>Low</i>	<i>High</i>	<i>High</i>
CO5	<i>High</i>	<i>High</i>	<i>High</i>	<i>Medium</i>	<i>Low</i>	<i>High</i>	<i>High</i>
CO6	<i>High</i>	<i>High</i>	<i>High</i>	<i>High</i>	<i>Low</i>	<i>High</i>	<i>Medium</i>
Correlation Levels: <i>Low Medium High</i>							

Mapping of Course Outcomes to Programme Specific Outcomes (PSOs)

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	<i>Medium</i>	<i>High</i>	<i>High</i>	<i>High</i>	<i>Medium</i>	<i>High</i>	<i>High</i>
CO2	<i>Medium</i>	<i>High</i>	<i>Medium</i>	<i>High</i>	<i>Low</i>	<i>High</i>	<i>High</i>
CO3	<i>Medium</i>	<i>High</i>	<i>High</i>	<i>Medium</i>	<i>Medium</i>	<i>High</i>	<i>Medium</i>
CO4	<i>High</i>	<i>High</i>	<i>High</i>	<i>High</i>	<i>Medium</i>	<i>High</i>	<i>High</i>
CO5	<i>Medium</i>	<i>High</i>	<i>High</i>	<i>High</i>	<i>Low</i>	<i>High</i>	<i>High</i>
CO6	<i>High</i>	<i>High</i>	<i>High</i>	<i>High</i>	<i>High</i>	<i>Low</i>	<i>High</i>
Correlation Levels: <i>LowMediumHigh</i>							

23. Statistical Practical III

24. Nann Mudhalvan

25. Environmental Studies

SEMESTER – IV

26. TAMIL

27. ENGLISH

28. TESTING OF STATISTICAL HYPOTHESIS

Course Code	TITLE OF THE COURSE	L	T	P	C
Core	TESTING OF STATISTICAL HYPOTHESIS	4	0	0	4
Prerequisites	Knowledge of Probability Theory, Distribution Theory and Estimation Theory	Syllabus Version		2024-25	

L: Lecture T: Tutorial P: Practical C: Credits

Course Objectives:

The main objectives of this course are to

- Formulate statistical hypotheses testing problems for given decision-making situations.
- Facilitate developing decision-making procedures for testing various parametric hypotheses
- Impart applications of nonparametric methods for decision-making

Course Outcomes (COs):

At the end of this course of study, the student will be able to

CO No.	Course Outcome	Cognitive Level
CO1	Formulate hypotheses testing problems	K1
CO2	Evaluate and to select appropriate parametric tests	K5
CO3	Develop most powerful test for testing simple hypotheses.	K1 – K4
CO4	Construct a nontrivial test for any hypotheses testing problem	K3 & K6
CO5	Apply nonparametric methods for drawing inferences	K3
CO6	Develop computer programs for carrying out computations related to this course	K1 – K6

K1: Remember K2: Understand K3: Apply K4: Analyze K5: Evaluate K6: Create

Course Outline:

Unit - I

Statistical hypotheses- simple and composite hypotheses - null and alternative hypotheses-critical region- two kinds of errors. Randomized and non-randomized tests -most powerful test- Neyman-Pearson lemma. Simple problems.

Unit - II

Likelihood ratio test- construction of tests for mean, equality of two means (independent samples), variance and equality of variances of normal populations.

Unit - III

Tests of significance: sampling distribution, standard error. Large sample tests concerning mean(s), variance(s), proportion(s) and correlation coefficient – simple problems.

Unit - IV

Tests of significance: Exact tests based on t , F and chi -square distributions concerning mean(s), variance(s), correlation coefficient(s) - Partial and multiple correlation coefficients. Chi – square test - contingency table-test for goodness of fit, test for independence of attributes, test for association – simple problems.

Unit - V

Non-parametric tests – advantages and disadvantages of nonparametric tests- test for randomness, Kolmogorov -Smirnov test, sign test, median test, Mann-Whitney U test, and Wilcoxon's signed - rank test – simple problems and applications.

UNIT - VI

Contemporary issues: Experts' lectures – online seminars and webinars. [2 hours]

BOOKS FOR STUDY:

1. Goon, A. M., M.K. Gupta, and B. Dasgupta (2002) Fundamentals of Statistics, Vol. I, (Third Edition), World press Ltd, Kolkata.
2. Alexander, M. Mood, Franklin A. Graybill and Duane C. Boes (2017). Introduction to the Theory of Statistics (Third Edition), Mc Graw Hill Education, New Delhi.

BOOKS FOR REFERENCE:

1. Bhuyan K.C. (2010), Probability Distribution Theory and Statistical Inference, New Central Book Agency (P) Ltd., New Delhi.
2. Gupta, S. C., and V. K. Kapoor (2020) Fundamentals of Mathematical Statistics, (Twelfth Edition). Sultan Chand & Sons, New Delhi.
3. Robert, V. Hogg, Joseph W. McKean and Allen T. Craig (2013) Introduction to Mathematical Statistics (Seventh Edition), Pearson Education, New York.
4. Rohatgi, V. K. and A. K. Md. E. Saleh (2009). An Introduction to Probability Theory and Mathematical Statistics (Second Edition). John Wiley & Sons, New York.

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

1. <https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=+u3y6UdbIvOJ97LFeSCmHQ==P-05>. Statistical inference II.
2. [https://nptel.ac.in/courses/111105043/Statistical Inference-IIT Kharagpur](https://nptel.ac.in/courses/111105043/Statistical%20Inference-IIT%20Kharagpur).
3. [https://nptel.ac.in/courses/111105124/Statistical Inference-IIT Kharagpur](https://nptel.ac.in/courses/111105124/Statistical%20Inference-IIT%20Kharagpur)

Mapping of Course Outcomes to Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	High	Low	Medium	High	Medium	Medium	Medium
CO2	High	Medium	Medium	High	Medium	High	High
CO3	High	High	High	High	Low	High	High
CO4	High	High	Medium	Medium	Low	High	High
CO5	High	High	High	Medium	Low	High	High
CO6	High	High	High	High	High	High	High
Correlation Level: <i>LowMediumHigh</i>							

Mapping of Course Outcomes to Programme Specific Outcomes

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	Medium	Medium	High	High	Medium	Medium	Medium
CO2	High	High	High	Medium	High	High	High
CO3	High	High	High	Medium	High	High	High
CO4	Medium	High	High	Medium	High	High	High
CO5	Medium	High	High	Medium	Medium	Low	High
CO6	High	High	High	High	High	Low	High
Correlation Level: <i>LowMediumHigh</i>							

29. ACTUARIAL STATISTICS

Course Code	TITLE OF THE COURSE	L	T	P	C
Core	ACTUARIAL STATISTICS	4	0	0	4
Prerequisites	Basic knowledge of Actuarial Statistics	Syllabus Version		2024-25	

Course Objectives:

The main objectives of this course are to

- It develops a greater understanding of statistical principles and their application in actuarial statistics.
- Describe the core areas of actuarial practice and relate to those areas actuarial principles, theories and models.
- It gives the understanding of the application knowledge of the life insurance environment.

Course Outcomes (COs):

At the end of this course of study, the student will be able to

CO No.	Course Outcome	Cognitive Level
CO1	To explain the utility theory and insurance terminologies.	K1, K2
CO2	To articulate the assurance and annuity benefits through multiple life function evaluation for special mortality laws.	K1-K5
CO3	To describe the various types of premium and their numerical evaluations.	K2-K5
CO4	To explain implementation of the Life insurance policies.	K2, K4
CO5	To describe Insurance payable at the moment of death and at the end of the year of death-level benefit insurance.	K1-K6
CO6	To understand real life problems related to insurance	K1-K6
K1: Remember K2: Understand K3: Apply K4: Analyze K5: Evaluate K6: Create		

Course Outline:

Unit-I

Simple and compound interest, present value and accumulated values of fixed rate, varying rate of interest.

Unit -II

Mortality: Gompertz - Makeham laws of mortality - life tables. Annuities: Endowments, Annuities, Accumulations, Assurances, Family income benefits.

Unit -III

Policy Values: Surrender values and paid up policies, industrial assurances, Joint life and last survivorship, premiums.

Unit -IV

Contingent Functions: Contingent probabilities, assurances. Decrement tables. Pension funds: Capital sums on retirement and death, widow's pensions, benefits dependent on marriage.

Unit -V

Principles of insurance, pure endowment, whole life assurance, Net premium for assurance and annuity plans-level annual premium under temporary assurance.

UNIT VI

Contemporary Issues: Expert lectures, online seminars – webinars. [2 hours]

BOOKS FOR STUDY:

1. Hooker, P.F., Longley, L.H.-Cook (1957): Life and other Contingencies, Cambridge.
2. Alistair Neill (1977): Life contingencies, Heinemann professional publishing.
3. Gupta and Kapoor (2001) Fundamentals of Applied Statistics.

BOOKS FOR REFERENCE:

1. StudymaterialofIAI/IFoAofActuarialSocieties
2. Hosack,I.B., Pollard,J.H.andZehnwirth,B.(1999):Introductory statistics with applications in generalinsurance,Cambridge University.

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

1. <https://epgp.inflibnet.ac.in/ahl.php?csrno=34>, P-10. Stochastic Processes and Time Series Analysis.
2. <https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=+u3y6UdbIvOJ97LFeSCmHQ==> P-10. Statistical processes and time series analysis.

Mapping of Course Outcomes to Programme Outcomes

	<i>PO1</i>	<i>PO2</i>	<i>PO3</i>	<i>PO4</i>	<i>PO5</i>	<i>PO6</i>	<i>PO7</i>
<i>CO1</i>	<i>High</i>	<i>High</i>	<i>Medium</i>	<i>High</i>	<i>Meidum</i>	<i>High</i>	<i>High</i>
<i>CO2</i>	<i>High</i>	<i>High</i>	<i>High</i>	<i>High</i>	<i>Medium</i>	<i>High</i>	<i>High</i>
<i>CO3</i>	<i>High</i>	<i>High</i>	<i>High</i>	<i>Medium</i>	<i>High</i>	<i>Medium</i>	<i>High</i>
<i>CO4</i>	<i>High</i>	<i>High</i>	<i>High</i>	<i>Medium</i>	<i>High</i>	<i>High</i>	<i>Medium</i>
<i>CO5</i>	<i>High</i>	<i>High</i>	<i>High</i>	<i>Medium</i>	<i>Medium</i>	<i>High</i>	<i>High</i>
<i>CO6</i>	<i>High</i>	<i>Medium</i>	<i>Medium</i>	<i>High</i>	<i>Medium</i>	<i>High</i>	<i>High</i>
Correlation Level: <i>Low Medium High</i>							

Mapping of Course Outcomes to Programme Specific Outcomes

	<i>PSO1</i>	<i>PSO2</i>	<i>PSO3</i>	<i>PSO4</i>	<i>PSO5</i>	<i>PSO6</i>	<i>PSO7</i>
<i>CO1</i>	<i>Medium</i>	<i>High</i>	<i>High</i>	<i>High</i>	<i>Medium</i>	<i>High</i>	<i>High</i>
<i>CO2</i>	<i>Medium</i>	<i>High</i>	<i>Medium</i>	<i>High</i>	<i>High</i>	<i>High</i>	<i>High</i>
<i>CO3</i>	<i>Medium</i>	<i>High</i>	<i>High</i>	<i>High</i>	<i>High</i>	<i>High</i>	<i>Medium</i>
<i>CO4</i>	<i>High</i>	<i>High</i>	<i>High</i>	<i>High</i>	<i>High</i>	<i>High</i>	<i>Medium</i>
<i>CO5</i>	<i>Medium</i>	<i>High</i>	<i>High</i>	<i>Medium</i>	<i>Medium</i>	<i>High</i>	<i>High</i>
<i>CO6</i>	<i>High</i>	<i>High</i>	<i>High</i>	<i>High</i>	<i>High</i>	<i>Medium</i>	<i>High</i>
Correlation Level: <i>LowMediumHigh</i>							

30. ECONOMIC & OFFICIAL STATISTICS

Course Code	TITLE OF THE COURSE	L	T	P	C
Core	ECONOMIC & OFFICIAL STATISTICS	4	0	0	4
Prerequisites	Basic Concepts of Time series and applied statistics	Syllabus Version		2024-25	

Course Objectives:

The main objectives of this course are to

- To understand Indian official statistical system and data collection
- To know Indian economic and agricultural surveys

- To know index numbers and consumer price index
- To know time series analysis
- To learn demand analysis and its concepts

Course Outcomes (COs):

At the end of this course of study, the student will be able to

CO No.	Course Outcome	Cognitive Level
CO1	Understand Indian official statistics and offices related to it.	K1, K2
CO2	Understand Indian surveys for collecting offices related to it.	K1-K5
CO3	Know uses of index numbers.	K1-K3
CO4	Understand Time series analysis and its need.	K2, K4
CO5	Know demand analysis and its need.	K1,K2,K4
CO6	To know the time series and prediction.	K1-K6
K1: Remember K2: Understand K3: Apply K4: Analyze K5: Evaluate K6: Create		

Course Outline:

Unit-I

Indian Statistical System: Data Collection for Governance – NSSO and its role in national data collection. NSSO reports and publications.

Unit -II

Economic Statistics: Information collection for Socio-Economic Survey – Agricultural, Industrial, Crime Statistics and Statistical methods applied to analyse large volumes of data.

Unit -III

Index numbers: Basic problems in the construction of index numbers. Methods- Simple and Weighted aggregate-Average of price relatives- Chain base method. Criteria of the goodness-Unit test, Time Reversal Factor Reversal and Circular tests.

Unit -IV

Time Series: Measurement of Trend: Graphic, Semi-averages, Moving averages. Least Squares – Straight line, Second-degree parabola, Exponential curve, Modified Exponential curve, Gompertz curve and Logistic curve. Measurement of Seasonal variation by Ratio-to-Moving average method.

Unit -V

Demand Analysis: Introduction-Demand and Supply, Price elasticity of demand and supply, partial and cross elasticities of demand.

UNIT VI

Contemporary Issues: Expert lectures, online seminars – webinars. [2 hours]

BOOKS FOR STUDY:

1. Gupta S.C. and Kapoor V.K. (2007) :Fundamentals of Applied Statistics , 4th edition ,Sultan Chand & Sons Publishers, New Delhi.
2. Gupta S.P. (2011) :Statistical Methods , Sultan Chand & Sons Publishers, New Delhi.
3. Websites of Government of India – Ministry of Statistics & Programme Implementation

BOOKS FOR REFERENCE:

1. Spyros Makridakis, Steven C. Wheelwright and Rob J .Hyndman (2003) :Forecasting Methods and Applications ,3rd Edition ,John Wiley and Sons Inc. .
2. Irving W. Burr (1974): Applied Statistical Methods, Academic Press.

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

1. <https://epgp.inflibnet.ac.in/ahl.php?csrno=34>, P-10. Stochastic Processes and Time Series Analysis.
2. <https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=+u3y6UdbIvOJ97LFeSCmHQ==> P-10. Statistical processes and time series analysis.

Mapping of Course Outcomes to Programme Outcomes

	<i>PO1</i>	<i>PO2</i>	<i>PO3</i>	<i>PO4</i>	<i>PO5</i>	<i>PO6</i>	<i>PO7</i>
<i>CO1</i>	<i>High</i>	<i>High</i>	<i>Medium</i>	<i>High</i>	<i>Medium</i>	<i>High</i>	<i>High</i>
<i>CO2</i>	<i>High</i>	<i>High</i>	<i>High</i>	<i>High</i>	<i>Medium</i>	<i>High</i>	<i>High</i>
<i>CO3</i>	<i>High</i>	<i>High</i>	<i>High</i>	<i>Medium</i>	<i>High</i>	<i>Medium</i>	<i>High</i>
<i>CO4</i>	<i>High</i>	<i>High</i>	<i>High</i>	<i>Medium</i>	<i>High</i>	<i>High</i>	<i>Medium</i>
<i>CO5</i>	<i>High</i>	<i>High</i>	<i>High</i>	<i>Medium</i>	<i>Medium</i>	<i>High</i>	<i>High</i>
<i>CO6</i>	<i>High</i>	<i>Medium</i>	<i>High</i>	<i>Medium</i>	<i>Medium</i>	<i>High</i>	<i>High</i>
Correlation Level:	<i>Low</i>	<i>Medium</i>	<i>High</i>				

Mapping of Course Outcomes to Programme Specific Outcomes

	<i>PSO1</i>	<i>PSO2</i>	<i>PSO3</i>	<i>PSO4</i>	<i>PSO5</i>	<i>PSO6</i>	<i>PSO7</i>
<i>CO1</i>	<i>Medium</i>	<i>High</i>	<i>High</i>	<i>High</i>	<i>Medium</i>	<i>High</i>	<i>High</i>
<i>CO2</i>	<i>Medium</i>	<i>High</i>	<i>Medium</i>	<i>High</i>	<i>High</i>	<i>High</i>	<i>High</i>
<i>CO3</i>	<i>Medium</i>	<i>High</i>	<i>High</i>	<i>High</i>	<i>High</i>	<i>High</i>	<i>Medium</i>
<i>CO4</i>	<i>High</i>	<i>High</i>	<i>High</i>	<i>High</i>	<i>High</i>	<i>High</i>	<i>Medium</i>
<i>CO5</i>	<i>Medium</i>	<i>High</i>	<i>High</i>	<i>Medium</i>	<i>Medium</i>	<i>High</i>	<i>High</i>
<i>CO6</i>	<i>High</i>	<i>High</i>	<i>High</i>	<i>High</i>	<i>High</i>	<i>Medium</i>	<i>High</i>
Correlation Level:	<i>Low</i>	<i>Medium</i>	<i>High</i>				

31. STATISTICS PRACTICAL – IV

32. NANN MUDHALVAN

33. VALUE EDUCATION

MSU

SEMESTER – V

34. STOCHASTIC PROCESSES

Course Code	TITLE OF THE COURSE	L	T	P	C
Core	STOCHASTIC PROCESSES	4	1	0	4
Prerequisites	Knowledge of Probability Theory and Distribution Theory	Syllabus Version		2024-25	

L: Lecture T: Tutorial P: Practical C: Credits

Course Objectives:

The main objectives of this course are to

- Understand concept of stochastic process with illustrations
- Provide knowledge on classification and properties of stochastic processes
- Facilitate to learn theoretical concepts pertaining to handling various stochastic models.
- Impart the application of various stochastic models for forecasting and prediction.

Course Outcomes (COs):

At the end of this course of study, the student will be able to

CO No.	Course Outcome	Cognitive Level
CO1	Classify of given stochastic process and to study its stationary properties.	K1, K2 & K4
CO2	Determine transition probability matrix for given Markov chain.	K1 - K3
CO3	Study the properties of states of Markov Chain and classify them.	K1 - K3
CO4	Perform computations related to Poisson Process, Birth and Death process and their differential and difference equations.	K3 & K4
CO5	Understand the concept of Queueing models, their Classifications and applications	K1, K3 & K6
CO6	Develop computer programs for carrying out computations related to this course	K1 – K6

K1:Remember K2:Understand K3:Apply K4:Analyze K5:Evaluate K6:Create

Course Outline:

Unit - I

Elements of Stochastic Processes: Basic terminologies. Classification of stochastic processes according to state space and domain-Elementary ideas on the Poisson process and Wiener process-Martingales-Markov processes- Stationary processes.

Unit - II

Markov Chain: definition-transition probability- discrete time Markov chain and transition probability matrix. Spatially homogeneous Markov Chain-one -dimensional

random walk.

Unit - III

Classification of states of Markov Chain. Reducible and irreducible Markov Chains - periodicity. Recurrent and transient states with examples. Concepts, results and problems concerning limiting probabilities (without Proof)- Simple problems.

Unit - IV

Classical examples of continuous time Markov Chain- infinitesimal generator - Poisson processes. General pure birth process and Yule's process. Birth and death processes - their differential and difference equations and solutions.

Unit - V

Queueing models and Classifications – Queueing system - Definition of transient and Steady-states - Kendall's notations and classification of queueing models - Distributions in queueing systems.

UNIT - VI

Contemporary issues: Experts' lectures – online seminars and webinars. [2 hours]

BOOK FOR STUDY:

1. Medhi, J. (2020) Stochastic Processes (Fifth Edition). Wiley Eastern Limited, New Delhi.
2. Samuel Karlin and Taylor (1975) A First Course in Stochastic Processes. Academic Press, New York.

BOOKS FOR REFERENCE:

1. Bhat, U. N. (1972) Elements of Applied Stochastic Processes. John Wiley & Sons, New York.
2. Basu, A.K. (2005) Introduction to Stochastic Process, Narosa Publishing House Pvt. Ltd., New Delhi.
3. Ross, S.M (1983): Stochastic Processes, John Wiley and Sons, New York.

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

1. <https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=34> Paper: P-10. Stochastic Processes and Time Series Analysis - ISI, Kolkata
2. <https://nptel.ac.in/courses/111/103/111103022/> Stochastic Processes – IIT Guwahati
3. <https://nptel.ac.in/courses/111/102/111102098/> Introduction and Motivation for studying Stochastic Processes – IIT Delhi
4. <https://ocw.mit.edu/courses/mathematics/18-445-introduction-to-stochastic-processes-spring2015/lecture-notes/>
5. <https://www.stat.auckland.ac.nz/~fewster/325/notes/325book.pdf>

Mapping of Course Outcomes to Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	<i>High</i>	<i>High</i>	<i>High</i>	<i>High</i>	<i>High</i>	<i>High</i>	<i>High</i>
CO2	<i>High</i>	<i>Medium</i>	<i>High</i>	<i>Medium</i>	<i>Low</i>	<i>High</i>	<i>High</i>
CO3	<i>High</i>	<i>High</i>	<i>High</i>	<i>High</i>	<i>Medium</i>	<i>High</i>	<i>High</i>
CO4	<i>High</i>	<i>Medium</i>	<i>Medium</i>	<i>Medium</i>	<i>Medium</i>	<i>Medium</i>	<i>High</i>
CO5	<i>High</i>	<i>High</i>	<i>High</i>	<i>Medium</i>	<i>Medium</i>	<i>Medium</i>	<i>High</i>
CO6	<i>High</i>	<i>High</i>	<i>High</i>	<i>High</i>	<i>Medium</i>	<i>High</i>	<i>High</i>
Correlation Level: <i>LowMediumHigh</i>							

Mapping of Course Outcomes to Programme Specific Outcomes

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	<i>High</i>	<i>High</i>	<i>High</i>	<i>Medium</i>	<i>High</i>	<i>High</i>	<i>High</i>
CO2	<i>Medium</i>	<i>High</i>	<i>High</i>	<i>Low</i>	<i>High</i>	<i>High</i>	<i>High</i>
CO3	<i>High</i>	<i>High</i>	<i>High</i>	<i>Medium</i>	<i>High</i>	<i>High</i>	<i>High</i>
CO4	<i>High</i>	<i>High</i>	<i>High</i>	<i>Medium</i>	<i>Medium</i>	<i>High</i>	<i>High</i>
CO5	<i>High</i>	<i>Medium</i>	<i>High</i>	<i>High</i>	<i>Low</i>	<i>Medium</i>	<i>High</i>
CO6	<i>Medium</i>	<i>High</i>	<i>High</i>	<i>Medium</i>	<i>Low</i>	<i>High</i>	<i>High</i>
Correlation Level: <i>LowMediumHigh</i>							

35. REGRESSION ANALYSIS

Course Code	TITLE OF THE COURSE	L	T	P	C
Elective	REGRESSION ANALYSIS	4	1	0	4
Prerequisites	Knowledge of correlation and regression Analysis	Syllabus Version		2024-25	

L: Lecture T: Tutorial P: Practical C: Credits

Course Objectives:

The main objectives of this course are to

- Impart knowledge on regression models, their construction and interpretations.
- Instill the practice of validating the constructed models.
- Facilitate to investigate the properties of regression models.

Course Outcomes (COs):

At the end of this course of study, the student will be able to

CO No.	Expected Course Outcomes	Cognitive Level
CO1	Understand the fundamental concepts and a methods of Regression model.	K2, K3
CO2	Examine the model assumptions	K3
CO3	Construction of Simple and Multiple Linear models regression.	K3,K6
CO4	Investigate the presence of multicollinearity and to learn overcoming the issues.	K4,K5
CO5	Understand the concept of non-linear methods and its applications	K3,K6
CO6	Develop computer programs for carrying out computations related to this course	K1- K6

K1:Remember K2:Understand K3:Apply K4:Analyze K5:Evaluate K6:Create

Course Outline:

Unit – I

Simple Linear Regression Model – Definition, description of data model, parameters estimation using OLS method. Properties of OLS estimators. Residuals – Concept and Properties. Analysis, Interpretation and Applications of the model.

Unit – II

Effect of outliers in Simple Linear Regression Model – Model adequacy and residual plots – deletion of data-points – Transformation of variables to stabilize variance. Concept of Heteroscedasticity.

Unit – III

Multiple Regression Model: Concept and description of data model. Model parameter estimation using OLS – Predicted values and standard errors. Concept of partial F – Test. Selection of variables – Forwards selection procedure and Backward elimination procedure.

Unit - IV

Multicollinearity and its effects on inference and forecasting – Concept on sources of multicollinearity. Detection procedures of multicollinearity. Method of overcoming multicollinearity problem.

Unit - V

Non-linear regression – transformation to a linear model, their use and limitations, initial estimates (starting values), parameter estimation using iterative procedures – Gauss-Newton, steepest Descent.

UNIT - VI

Contemporary issues: Experts' lectures – online seminars and webinars. [2 hours]

BOOKS FOR STUDY:

1. Montgomery, D.C., Peck, E.A., Geoffrey, G.V.(2012). Introduction to Linear Regression Analysis, 5th Edition, John Wiley & Sons, Inc.
2. Draper, N.R. and Smith, H. (2003): Applied Regression Analysis, third edition, John Wiley and Sons, Inc.

BOOKS FOR REFERENCE:

1. Hadi, A.S. and Chakraborti, S., (2015). Regression Analysis by Example, 5th Edition, John Wiley & Sons, Inc.
2. Gujarati, D.(2004): Introduction to Econometrics. McGraw Hill, New Delhi.
3. A. Sen, M. Srivastava, Regression Analysis — Theory, Methods, and Applications, Springer-Verlag, Berlin, 2011.
4. Iain Pardoe (2012): Applied regression Modeling, second edition, Wiley

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

1. <https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=+u3y6UdbIvOJ97LFeSCmHQ==P-07.Regression analysis I>
2. <https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=+u3y6UdbIvOJ97LFeSCmHQ==P-08.Regression analysis II>

Mapping of Course Outcomes to Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	High	High	Low	Medium	High	High	Medium
CO2	High	High	Medium	Medium	High	High	Medium
CO3	High	High	Low	Medium	High	High	Medium
CO4	High	High	Medium	Medium	High	High	Medium
CO5	High	High	Medium	Medium	High	High	Medium
CO6	High	High	High	High	High	High	High
Correlation Level:	LowMediumHigh						

Mapping of Course Outcomes to Programme Specific Outcomes

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	Medium	Medium	High	High	Medium	High	High
CO2	Medium	High	Medium	Medium	High	High	High
CO3	Medium	High	High	High	High	High	Medium
CO4	High	Medium	High	High	High	High	Medium
CO5	Medium	High	High	Medium	Medium	High	High
CO6	High	High	High	High	High	Low	High
Correlation Level:	LowMediumHigh						

36. STATISTICS PRACTICAL V

37. PROJECT WITH VIVA VOCE

38. OPERATIONS RESEARCH

Course Code	TITLE OF THE COURSE	L	T	P	C
Core	OPERATIONS RESEARCH	4	1	0	4
Prerequisites	Basic knowledge of game theory LPP problems	Syllabus Version		2024-25	

L: Lecture T: Tutorial P: Practical C: Credits

Course Objectives:

The main objectives of this course are to

- Optimization techniques
- Transportation problems
- Game theory
- Replacement problems
- Network analysis

Course Outcomes (COs):

At the end of this course of study, the student will be able to

CO No.	Course Outcome	Cognitive Level
CO1	Understand optimization techniques and solving set of equations with constraints.	K1, K2
CO2	Solve problems of linear programming.	K1-K5
CO3	Understand transportation problems and its applications.	K1-K3
CO4	Solve problems using games theory.	K2- K4
CO5	Do replacement problems and solve it.	K1-K4
CO6	Do network analysis and get problem solving skills	K1-K6
K1: Remember K2: Understand K3: Apply K4: Analyze K5: Evaluate K6: Create		

Course Outline:

Unit-I

Formulation of Linear programming models – Graphical solution of LPP in two variables – LPP in standard form – Principles of Simplex method – Algorithm – Need for artificial variables – Charne’s M- Technique – Concept of degeneracy.

Unit - II

Transportation problem(TP) – TP formulation- North-West Corner, Least cost, Vogel’s Approximation method – UV-method – Assignment problem and algorithm.

Unit - III

Theory of Games – Basic definition – Maximin and Minimax criterion – Solution of Games with saddle points – Two-by-Two (2x2) Games without saddle point – principle of dominance – problems based on dominance rule – Graphical method for (2xn) and (mx2) games.

Unit - IV

Replacement problems – Replacement policy for items whose maintenance cost increases with time and the value of money remains constant – Replacement policy for items whose maintenance cost increases with time and the value of money also changes with time.

Unit - V

Network analysis by CPM/PERT: Basic Concept – Constraints in Network – Construction of the Network – Time calculations – Concept of slack and float in Network Analysis – Finding optimum project duration and minimum project cost.

UNIT - VI

Contemporary Issues: Expert lectures, online seminars – webinars. [2 hours]

BOOKS FOR STUDY:

1. N.H. Shah, Ravi M.Gor, Hardik Soni (2010) Operation Research, PHI Learning Private Limited, New Delhi.
2. Kanti Swarup, P.K. Gupta and Manmohan (2007) Operations Research, Sultan Chand Sons, New Delhi.
3. S.D. Sharma (2002) : Operations Research: Kedarnath and Ramnath, Meerut.
4. J.K. Sharma (2002) : Operations Research: Theory and application , Macmillan, India Ltd.

BOOKS FOR REFERENCE:

1. Taha , H.A (1987) Operations Research-An introduction (4th edition), Macmilan publishers.
2. F.S. Hiller and Liberman (1994): Operations Research, CBS Publishers and Distributions, New Delhi.

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

1. <https://epgp.inflibnet.ac.in/ahl.php?csrno=34>, P-10. Stochastic Processes and Time Series Analysis.
2. <https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=+u3y6UdbIvOJ97LFeSCmHQ==> P-10. Statistical processes and time series analysis.

Mapping of Course Outcomes to Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	High	High	Medium	High	Medium	High	High
CO2	High	High	High	High	Medium	High	High
CO3	High	High	High	Medium	High	Medium	High
CO4	High	High	High	Medium	High	High	Medium
CO5	High	High	High	Medium	Medium	High	High
CO6	High	Medium	High	Medium	Medium	High	High
Correlation Level: Low Medium High							

Mapping of Course Outcomes to Programme Specific Outcomes

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	Medium	High	High	High	Medium	High	High
CO2	Medium	High	Medium	High	High	High	High
CO3	Medium	High	High	High	High	High	Medium
CO4	High	High	High	High	High	High	Medium
CO5	Medium	High	High	Medium	Medium	High	High
CO6	High	High	High	High	High	Medium	High
Correlation Level: LowMediumHigh							

39. ECONOMETRICS

Course Code	TITLE OF THE COURSE	L	T	P	C
Core	ECONOMETRICS	4	2	0	4
Prerequisites	Knowledge of Micro Economics	Syllabus Version		2024-25	

L: Lecture T: Tutorial P: Practical C: Credits

Course Objectives:

The main objectives of this course are to

- Provide knowledge on basic principles of econometric models.
- Construct and validate models for given economic data.
- Inculcate the applications of econometrics in various fields.

Course Outcomes (COs):

At the end of this course of study, the student will be able to

CO No.	Course Outcome	Cognitive Level
CO1	Understand the basic concepts of Econometrics, methodology and limitations of using Econometric theory	K1 & K2
CO2	Acquire knowledge on Least square estimators.	K2 & K3
CO3	Evaluate the model adequacy conducting Residual analysis	K3 & K5
CO4	Detect presence of autocorrelation through analytical methods	K3 & K4
CO5	Detect presence of multicollinearity and to overcome such issues	K3 & K5
CO6	Develop computer programs for carrying out computations related to this course	K1 – K6
K1:Remember K2:Understand K3:Apply K4:Analyze K5:Evaluate K6:Create		

Course Outline:

Unit - I

Model with one explanatory variable: Definition, scope and objectives of Econometrics. Linear model with one independent variable - Least squares estimators of regression coefficients, properties of least squares estimators - analysis of variance to regression model.

Unit - II

Model with more variables: Linear model with more than one explanatory variables – assumptions – estimation of model parameter - Least squares estimators and their properties. Hypothesis testing – test the overall significance of the regression – Testing the individual regression coefficients.

Unit - III

Adequacy of Model: Model adequacy checking – residual analysis – residuals – standardized residuals – residual plot – normal probability plot – plot of residuals against estimated response. A formal test for lack of fit of the model.

Unit - IV

Autocorrelation: Meaning of serial independence – sources of autocorrelation – first order autoregressive scheme – consequences of autocorrelation – Durbin – Watson test – analysing the model in the presence of autocorrelation.

Unit - V

Multicollinearity : meaning and sources – consequences of multicollinearity. Test for detecting multicollinearity – Examining the correlation matrix – Variance Inflation factor.

UNIT - VI

Contemporary issues: Experts' lectures – online seminars and webinars. [2 hours]

BOOKS FOR STUDY:

1. Montgomery, D.C, Peck, E.C and Vining, G.G (2003) Introduction to Linear Regression Analysis (Third Edition). Wiley India, New Delhi.
2. Koutsoyiannis, A. (2006) Theory of Econometrics. (Second Edition) Palgrave, New York.

BOOKS FOR REFERENCE:

1. Singh, S. P., Parashar, K. and Singh, H. P. (1980) Econometrics. Sultan Chand & Co., New Delhi.
2. Klein, L. R. (1975) A Text Book of Econometrics (Second Edition). Prentice Hall of India, New Delhi.
3. Johnston, J. and DiNardo, J. (1997). Econometric Methods, McGraw-Hill.
4. Gujarati, D.N. and Sangeetha (2007). Basic Econometrics (Third Edition). McGraw Hill Publisher, New York.
5. Wooldridge, J. (2012). Introduction Econometrics: A Modern Approach. Cengage Learning.

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

1. <https://epgp.inflibnet.ac.in/home/viewsubject?catid=+u3y6udbivoj971fescmhq==P-14>.
Econometrics and financial time series

Mapping of Course Outcomes to Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	High	High	Medium	High	Medium	High	High
CO2	High	Medium	High	High	Medium	High	High
CO3	High	High	Medium	High	Medium	High	High
CO4	High	Medium	Medium	Medium	Medium	High	High
CO5	High	High	High	Medium	High	Medium	High
CO6	High	Medium	High	High	Medium	High	High
Correlation Level: <i>LowMediumHigh</i>							

Mapping of Course Outcomes to Programme Specific Outcomes

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	Medium	High	High	Medium	High	High	High
CO2	Medium	Medium	High	Medium	Medium	Medium	High
CO3	High	High	High	Medium	High	High	High
CO4	Medium	High	High	Medium	Medium	Medium	High
CO5	High	Medium	High	High	Low	Medium	High
CO6	Medium	High	High	Medium	Low	High	High
Correlation Level: <i>LowMediumHigh</i>							

39. POPULATION STUDIES

Course Code	TITLE OF THE COURSE	L	T	P	C
Core	POPULATION STUDIES	4	1	0	4
Prerequisites	Basic Concepts Population studies	Syllabus Version		2024-25	

L: Lecture T: Tutorial P: Practical C: Credits

Course Objectives:

The main objectives of this course are to

- To identify appropriate sources of data with basic vital statistics analyses
- To relate the population with standardized death rates
- To utilize the mortality table to find the survival and death rates
- To analyze the birth rate used to describe fertility in the populations

Course Outcomes (COs):

At the end of this course of study, the student will be able to

CO No.	Course Outcome	Cognitive Level
CO1	To understand need of population study	K1, K2
CO2	Provide the basic knowledge in Measurements Population and obtain the various Demographic Determinants.	K2
CO3	Relate understand fertility and mortality effect on population	K1-K3
CO4	Describe and explore the importance of Risk Measures and Morbidity Rates	K2-K5
CO5	Understand the concepts of vital statistics.	K2,K4
CO6	Develop computer programs for carrying out computations related to this course	K1-K6
K1: Remember K2: Understand K3: Apply K4: Analyze K5: Evaluate K6: Create		

Course Outline:

Unit-I

Introduction: Definition, nature and scope of Population Studies, relationship of other social sciences with population studies - Advantages of Population Study.

Unit -II

Concept of Natural Increase of Population and Growth of Population - Measurement and Indicators of Demographic Determinants: Fertility, Mortality, Migration, Marriage.

Unit - III

Fertility Rates Crude Birth Rate - General Fertility Rate - Age Specific Fertility Rate - Total Fertility Rate - Gross Reproduction Rate (GRR) - Net Reproduction Rate (NRR) - Replacement level Fertility - Birth order statistics - Child Women ratio - Order Specific Fertility Measures - Theory and simple Problems.

Unit -IV

Risk Measures Ratios, Proportions, and Rates - its properties, uses and simple problems; Morbidity Rates: Incidence proportions, Incidence rates, Prevalence rates - Definition, properties, uses and simple problems.

Unit -V

Vital Statistics - Definition, Nature, Scope and Methods of vital statistics data - Measurement of Population - Development of Population Studies in India.

UNIT VI

Contemporary Issues: Expert lectures, online seminars - webinars. [2 hours]

BOOKS FOR STUDY:

1. Gupta S.P. & Kapoor V.K., Fundamentals of Applied Statistics, Sultan Chand & Sons, 2019.
2. Asha A. Bhende and Tara Karitkar (1994) Principles of Population Studies, Himalaya Publishing House Pvt Ltd., Mumbai.

BOOKS FOR REFERENCE:

1. Misra, B.D. (1982). An Introduction to the Study of Population. South East Asia Publishers, Madras.
2. Peter R Cox, Demography, 5th Edition, Vikas Publishing House, 1979.
3. Agarwal S.N, India's Population Problems, Tata McGraw Hill, 1981.
4. Srinivasan, K, Basic Demographic Techniques and Applications, Sage Publications, New Delhi, 1998.

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

1. <https://www.cdc.gov/csels/dsepd/ss1978/lesson3/section1.html>

Mapping of Course Outcomes to Programme Outcomes

	<i>PO1</i>	<i>PO2</i>	<i>PO3</i>	<i>PO4</i>	<i>PO5</i>	<i>PO6</i>	<i>PO7</i>
<i>CO1</i>	<i>High</i>	<i>High</i>	<i>Medium</i>	<i>High</i>	<i>Medium</i>	<i>High</i>	<i>High</i>
<i>CO2</i>	<i>High</i>	<i>High</i>	<i>High</i>	<i>High</i>	<i>Medium</i>	<i>High</i>	<i>High</i>
<i>CO3</i>	<i>High</i>	<i>High</i>	<i>High</i>	<i>Medium</i>	<i>High</i>	<i>Medium</i>	<i>High</i>
<i>CO4</i>	<i>High</i>	<i>High</i>	<i>High</i>	<i>Medium</i>	<i>High</i>	<i>High</i>	<i>Medium</i>
<i>CO5</i>	<i>High</i>	<i>High</i>	<i>High</i>	<i>Medium</i>	<i>Medium</i>	<i>High</i>	<i>High</i>
<i>CO6</i>	<i>High</i>	<i>Medium</i>	<i>High</i>	<i>Medium</i>	<i>Medium</i>	<i>High</i>	<i>High</i>
Correlation Level: Low Medium High							

Mapping of Course Outcomes to Programme Specific Outcomes

	<i>PSO1</i>	<i>PSO2</i>	<i>PSO3</i>	<i>PSO4</i>	<i>PSO5</i>	<i>PSO6</i>	<i>PSO7</i>
<i>CO1</i>	<i>Medium</i>	<i>High</i>	<i>High</i>	<i>High</i>	<i>Medium</i>	<i>High</i>	<i>High</i>
<i>CO2</i>	<i>Medium</i>	<i>High</i>	<i>Medium</i>	<i>High</i>	<i>High</i>	<i>High</i>	<i>High</i>
<i>CO3</i>	<i>Medium</i>	<i>High</i>	<i>High</i>	<i>High</i>	<i>High</i>	<i>High</i>	<i>Medium</i>
<i>CO4</i>	<i>High</i>	<i>High</i>	<i>High</i>	<i>High</i>	<i>High</i>	<i>High</i>	<i>Medium</i>
<i>CO5</i>	<i>Medium</i>	<i>High</i>	<i>High</i>	<i>Medium</i>	<i>Medium</i>	<i>High</i>	<i>High</i>
<i>CO6</i>	<i>High</i>	<i>High</i>	<i>High</i>	<i>High</i>	<i>High</i>	<i>Medium</i>	<i>High</i>
Correlation Level: LowMediumHigh							

40. NANN MUDHALVAN

41. INTERNSHIP

SEMESTER – VI

42. DESIGN OF EXPERIMENTS

Course Code		TITLE OF THE COURSE	L	T	P	C
Core		DESIGN OF EXPERIMENTS	4	1	0	4
Prerequisites		Basic knowledge ANOVA and experimental design	Syllabus Version		2024-25	

L: Lecture T: Tutorial P: Practical C: Credits

Course Objectives:

The main objectives of this course are to:

- Understand the need and the objectives of experimental designs.
- Inculcate the need for principles of experimental designs.
- plan and conduct designed experiments efficiently and effectively,
- analyze and interpret experimental results,
- Motivate towards construction of experimental designs.

Course Outcomes (COs):

At the end of this course of study, the student will be able to

CO No.	Course Outcome	Cognitive Level
CO1	Understand the basic principles and methods of experimental designs.	K2
CO2	Perform suitable post -ANOVA tests	K1,K2
CO3	Analyze the outcome of basic designs.	K1,K2,K5
CO4	Analyze the outcomes of factorial experiments.	K4,K6
CO5	Apply the concept of reduction in block sizes and analyze the results	K3,K4
CO6	Develop computer programs for carrying out computations related to this course	K1-K6

K1:Remember K2 : Understand K3: Apply K4:Analysis K5: Evaluate K6 : Create

Course Outline:

Unit - I

Fundamental principles of experiments – randomization, replication and local control. Size of experimental units. Analysis of variance- one-way and two-way classifications.

Unit - II

Post ANOVA Tests: Fisher Critical Difference Test, Multiple range test; Newman-Keul's test-Duncan's multiple range test-Tukey's test. Concept of Analysis of Covariance.

Unit - III

Analysis of Variance and Basic Designs: Concept of Cochran's Theorem. Completely randomized design(CRD)- Randomized Complete Block Design(RCBD) - Latin square design(LSD) and their analysis - Missing plot techniques in RCBD.

Unit - IV

Factorial experiments: 2^2 , 2^3 and 2^n factorial experiments. Definitions and their analyses.

Unit - V

Principles of confounding –partial and complete confounding in 2^3 – Introduction to Incomplete Block Design – Concept, definitions and examples of Balanced Incomplete Block Design (BIBD) – parametric relationship of BIBD.

UNIT - VI

Contemporary issues: Experts' lectures – online seminars and webinars. [2 hours]

BOOKS FOR STUDY:

1. Das, M.N. and Giri,N.C. (1988) Design and Analysis of Experiments(2nd Edition). New Age International, New Delhi.
2. Gupta, S. C. and V. K. Kapoor (1999) Fundamentals of Applied Statistics (Third Edition), Sultan Chand & Sons, New Delhi.
3. Agarwal, B.L., (2010). Theory and Analysis of Experimental Designs., CBS Publishers & Distributors Pvt. Ltd., New Delhi.

BOOKS FOR REFERENCE:

1. Douglas,C. Montgomery(2012) Design and Analysis of Experiments. John Wiley & sons, New York.
2. Dean, A and Voss (2006) Design and Analysis of Experiments. Springer India Private Limited, New Delhi.
3. Rangasamy, R (2010) A Textbook of Agricultural Statistics, New Age International Pvt Ltd.

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

1. <https://epgp.inflibnet.ac.in/home/viewsubject?catid=+u3y6udbivoj97lfescmhq==p-03>. Design of experiments and sample surveys.
2. <https://nptel.ac.in/courses/102106051>

Mapping of Course Outcomes to Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	High	Medium	High	High	Medium	High	High
CO2	High	High	High	High	High	High	High
CO3	High	High	Medium	Medium	Medium	High	High
CO4	High	High	High	Medium	High	High	High
CO5	High	Medium	Medium	High	Low	High	High
CO6	Medium	High	High	High	High	High	High
Correlation Level: LowMediumHigh							

Mapping of Course Outcomes to Programme Specific Outcomes

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	Medium	Medium	High	High	Medium	High	High
CO2	Medium	High	High	High	High	High	High
CO3	Medium	High	High	High	High	High	Medium
CO4	High	High	High	High	High	High	Medium
CO5	Medium	High	High	Medium	Medium	High	High
CO6	High	High	High	High	High	Low	High
Correlation Level: LowMediumHigh							

43. DEMOGRAPHY

Course Code	TITLE OF THE COURSE	L	T	P	C
Core	DEMOGRAPHY	4	2	0	4
Prerequisites	Basic ideas on demography, vital statistics, population migration and data sources.	Syllabus Version		2024-25	

L: Lecture T: Tutorial P: Practical C: Credits

Course Objectives:

The main objectives of this course are to

- Introduce the basic techniques of demographic analysis.
- Impart knowledge on sources of demographic data, perform basic demographic analysis and facilitate using various techniques to ensure their comparability across populations.
- Focus on measures of mortality, Fertility, Migration levels patterns and population projection techniques.
- Inculcate the practice of preparing lifetable and drawn informations.

Course Outcomes (COs):

At the end of this course of study, the student will be able to

CO No.	Course Outcome	Cognitive Level
CO1	Understand the concepts of demography, demographic data on its sources and learn the basics in Birth, Death and other vital statistics.	K1, K2
CO2	Evaluate fertility measures for a human population and to interpret them.	K3
CO3	Determine mortality measures for a human population and to interpret them.	K2, K4
CO4	Construct Lifetables; and understand the concept of Migration and its measures.	K3, K4
CO5	Understand the population growth, population projection and applications of Logistic curve.	K1-K3
CO6	Develop computer programs for carrying out computations related to this course	K1-K6
K1: Remember K2: Understand K3: Apply K4: Analyze K5: Evaluate K6: Create		

Course Outline:

Unit - I

Demography Data: Demography – definition-sources of demographic data - population census -demographic surveys - Registration method: vital registration - population register and other administrative records, registration of population in India.

Unit - II

Fertility: Fertility measurements – crude birth rates - general, specific and total fertility rates -gross and net reproduction rates and their interpretation.

Unit - III

Mortality: Mortality measurements: crude death rate - specific death rate - standardized death rate - infant mortality rate – maternal mortality rate – case fertility rate - comparative mortality index.

Unit – IV

Life Table and Migration: Description and construction of various columns of a life table and their relationships - uses of life table – migration-factors effecting migration - gross and net migration rates.

Unit - V

Population Growth: Population projection – population estimates and projection – arithmetic, geometric and exponential growth rates - logistic curve and its suitability for graduating population data - Basic ideas of stationary and stable population.

UNIT VI

Contemporary issues: Experts' lectures – online seminars and webinars. [2 hours]

Correlation Level: *LowMediumHigh*

44. STATISTICS PRACTICAL – VI

45. STATISTICAL QUALITY CONTROL

Course Code	TITLE OF THE COURSE	L	T	P	C
Core	STATISTICAL QUALITY CONTROL	4	1	0	4
Prerequisites	Estimation theory and Distribution theory	Syllabus Version		2024-25	

L: Lecture T: Tutorial P: Practical C: Credits

Course Objectives:

The main objectives of this course are to:

- To impart basic theoretical knowledge about terminologies, need of control charts for quality control, construct control limits of variables and attributes.
- To educate the learner to be able to construct control charts for defects, number of defects (c-chart); and control chart for number of defects per unit (u-chart).
- To educate acceptance sampling plan and discuss the procedure of its implementation, compute the probability of accepting or rejecting a lot.
- To define acceptance quality level (AQL) and lot tolerance percent defective (LTPD) of the lot; and compute the producer's risk and consumer's risk for an acceptance sampling plan.
- To facilitate the learner to understand the difference between attributes and variables sampling plans, the advantages and disadvantages of variables sampling.

Course Outcomes (COs):

At the end of this course of study, the student will be able to

CO No.	Course Outcome	Cognitive Level
CO1	Understand Industrial applications of Statistics	K1, K2
CO2	Understand statistical process control and methods for it	K1-K5
CO3	Understand attribute and variable control chart and interpret process based on it	K1-K3
CO4	Understand the situations using special purpose control charts	K2, K4
CO5	Know various product control techniques	K1,K2,K4
CO6	To do numerical problems and able to get critical thinking to solve problems To explore real life problems	K1-K6
K1: Remember K2: Understand K3: Apply K4: Analyze K5: Evaluate K6: Create		

Course Outline:

Unit-I

Importance and need for Statistical Quality Control Techniques in Industry – Causes of variations in Quality – Uses of Shewart's Control charts –Terminologies: Specification limits, Tolerance limits, 3σ limits. Advantages and Limitations of SQC.

Unit -II

Control charts variables: Control Chart for Mean (Xbar- Chart) ,Range Chart (R-Chart) , Standard Deviation Chart (S-Chart) – with simple problems.

Unit -III

Control Charts for Attributes: Control Chart for Fraction Defective (p Chart),p-Chart for Variable Sample Size , Control Chart for Number of Defectives (np-Chart). Control Charts for Defects: Control Chart for Number of Defects (C-Chart) and Control Chart for Number Of Defects Per Unit (U-Chart).

Unit -IV

Acceptance sampling plans for attributes –Types of Acceptance Sampling plans, Methods of Inspection: 100% Inspection and Sampling Inspection, Advantages and Limitations of Acceptance Sampling. Terms used in acceptance sampling plans: Lot, Lot Size, Sample Size, Lot Quality, Acceptance Number , Probability of accepting a lot (Pa) ,Acceptance Quality Level (AQL), Lot Tolerance Percent Defective (LTPD), Producer's Risk, Consumer's Risk, AOQ, AOQL, ATI and ASN.

Unit -V

Rectifying Sampling Plans. Single and Double sampling plans. OC, AOQ, ATI and ASN curves for Single and Double sampling plans.

UNIT VI

Contemporary Issues: Expert lectures, online seminars – webinars. [2 hours]

BOOKS FOR STUDY:

1. Douglas C. Montgomery (2005) : Introduction to Statistical Quality Control, John Wiley & Sons, New York. (Unit V: Chapter 16 (pages 670 to 680)
2. Gupta S.C and V.K.Kapoor (2007): Fundamentals of Applied Statistics, Sultan Chand Sons, New Delhi
3. Mahajan, M (1998) : Statistical Quality Control, Dhanpat Rao& Co, New Delhi.

BOOKS FOR REFERENCE:

1. Gupta, R.C.(1974): Statistical Quality Control, Khanna Publishers.
2. Ekambaram, S K. (1963): Statistical basis of Acceptance sampling, Asia Publishing House.
3. Grant, E,L. and Laven Worth, R.S.: Statistical Quality Control, McGraw Hill.

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

1. <https://epgp.inflibnet.ac.in/ahl.php?csrno=34>, P-10. Stochastic Processes and Time Series Analysis.
2. <https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=+u3y6UdbIvOJ97LFeSCmHQ==> P-10. Statistical processes and time series analysis.

Mapping of Course Outcomes to Programme Outcomes

	<i>PO1</i>	<i>PO2</i>	<i>PO3</i>	<i>PO4</i>	<i>PO5</i>	<i>PO6</i>	<i>PO7</i>
<i>CO1</i>	<i>High</i>	<i>High</i>	<i>High</i>	<i>High</i>	<i>High</i>	<i>High</i>	<i>High</i>
<i>CO2</i>	<i>High</i>	<i>High</i>	<i>High</i>	<i>High</i>	<i>Medium</i>	<i>High</i>	<i>High</i>
<i>CO3</i>	<i>High</i>	<i>High</i>	<i>High</i>	<i>High</i>	<i>High</i>	<i>Medium</i>	<i>High</i>
<i>CO4</i>	<i>High</i>	<i>High</i>	<i>High</i>	<i>High</i>	<i>High</i>	<i>High</i>	<i>Medium</i>
<i>CO5</i>	<i>High</i>	<i>High</i>	<i>Medium</i>	<i>Medium</i>	<i>Medium</i>	<i>High</i>	<i>High</i>
<i>CO6</i>	<i>High</i>	<i>Medium</i>	<i>High</i>	<i>Medium</i>	<i>High</i>	<i>High</i>	<i>High</i>
Correlation Level: <i>Low Medium High</i>							

Mapping of Course Outcomes to Programme Specific Outcomes

	<i>PSO1</i>	<i>PSO2</i>	<i>PSO3</i>	<i>PSO4</i>	<i>PSO5</i>	<i>PSO6</i>	<i>PSO7</i>
<i>CO1</i>	<i>Medium</i>	<i>High</i>	<i>High</i>	<i>High</i>	<i>Medium</i>	<i>High</i>	<i>High</i>
<i>CO2</i>	<i>Medium</i>	<i>High</i>	<i>Medium</i>	<i>High</i>	<i>High</i>	<i>High</i>	<i>High</i>
<i>CO3</i>	<i>Medium</i>	<i>High</i>	<i>High</i>	<i>High</i>	<i>High</i>	<i>High</i>	<i>Medium</i>
<i>CO4</i>	<i>High</i>	<i>High</i>	<i>High</i>	<i>High</i>	<i>High</i>	<i>High</i>	<i>Medium</i>
<i>CO5</i>	<i>Medium</i>	<i>High</i>	<i>High</i>	<i>Medium</i>	<i>Medium</i>	<i>High</i>	<i>High</i>
<i>CO6</i>	<i>High</i>	<i>High</i>	<i>High</i>	<i>High</i>	<i>High</i>	<i>Medium</i>	<i>High</i>
Correlation Level: <i>LowMediumHigh</i>							

46. TIME SERIES

Course Code	TITLE OF THE COURSE	L	T	P	C
Core	TIME SERIES	4	1	0	4
Prerequisites	Basic concepts of time series	Syllabus Version		2024-25	

L: Lecture T: Tutorial P: Practical C: Credits

Course Objectives:

The main objectives of this course are to

- On successful completion of this course, students will be able to acquire the knowledge of time series data and its applications.
- Outline the growth curves and their fitting.
- To calculate the seasonal indices by various methods.

Course Outcomes (COs):

At the end of this course of study, the student will be able to

CO No.	Course Outcome	Cognitive Level
CO1	Understand the time series concept	K1, K2
CO2	Estimate the trend values using various methods	K1-K5
CO3	Estimate the Seasonal Variations using various methods	K1-K3
CO4	Understand the concept of growth curves.	K1, K2
CO5	Determine how and when to apply De-Seasonalisation of data	K1,K2,K4
CO6	To do numerical problems and able to get critical thinking to solve problems To explore real life problems	K1-K6

K1: Remember**K2: Understand****K3: Apply****K4: Analyze****K5: Evaluate****K6: Create**

Course Outline:

Unit-I

Time Series Definition, uses, Additive Model, Multiplicative Models, Components - Secular Trend, Seasonal variation – Simple problems.

Unit -II

Measurement of Trend: Graphical method, Method of Semi - Averages, Method of Moving Averages and Method of Least Squares.

Unit -III

Measurement of Seasonal Variations Method of Simple Averages, Ratio to Moving Average method, Ratio to Trend Method and Link Relative Method - Cyclic Variation and Irregular fluctuations.

Unit -IV

Growth Curves Modified Exponential Curve and its Fitting – Method of Three Selected Points – Method of Partial Sums – Fitting of Gompertz Curve – Logistic Curve.

Unit -V

De-Seasonalization of data – Cyclic components: Harmonic analysis. Random component – Variate difference method. Weak Stationarity, autocorrelation function and the Correlogram.

UNIT VI

Contemporary Issues: Expert lectures, online seminars – webinars. [2 hours]

BOOKS FOR STUDY:

1. Gupta, S.C. and Kapoor, V.K.: Fundamentals of Applied Statistics, Sultan Chand & Co., 4 th Revised Edition, 2019.

BOOKS FOR REFERENCE:

1. Spyros Makridakis, Steven C. Wheelwright and Rob J .Hyndman (2003) :ForecastingMethods and Applications ,3rd Edition ,John Wiley and Sons Inc. .
2. Pillai RSN and Bagavathi V, Statistics, S. Chand & Co., 2010.
3. Box, G.E.P., Jenkins, G.M., Reinsel, G.C. and Ljung, G.M. Time Series Analysis: Forecasting and Control, 5th Edition, John Wiley & sons, Inc., 2015.
4. Brockwell, P.J. and Davis, R.A., Introduction to Time Series Analysis. Springer, 2003.

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

1. <https://epgp.inflibnet.ac.in/ahl.php?csrno=34>, P-10. Stochastic Processes and Time Series Analysis.
2. <https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=+u3y6UdbIvOJ97LFeSCmHQ==> P-10. Statistical processes and time series analysis.

Mapping of Course Outcomes to Programme Outcomes

	<i>PO1</i>	<i>PO2</i>	<i>PO3</i>	<i>PO4</i>	<i>PO5</i>	<i>PO6</i>	<i>PO7</i>
<i>CO1</i>	<i>High</i>	<i>High</i>	<i>Medium</i>	<i>Medium</i>	<i>Medium</i>	<i>High</i>	<i>Medium</i>
<i>CO2</i>	<i>High</i>	<i>High</i>	<i>High</i>	<i>High</i>	<i>Medium</i>	<i>High</i>	<i>Medium</i>
<i>CO3</i>	<i>High</i>	<i>High</i>	<i>High</i>	<i>Medium</i>	<i>High</i>	<i>High</i>	<i>Medium</i>
<i>CO4</i>	<i>High</i>	<i>High</i>	<i>High</i>	<i>Medium</i>	<i>High</i>	<i>High</i>	<i>High</i>
<i>CO5</i>	<i>High</i>	<i>High</i>	<i>Medium</i>	<i>Medium</i>	<i>Medium</i>	<i>High</i>	<i>High</i>
<i>CO6</i>	<i>High</i>	<i>Medium</i>	<i>High</i>	<i>Medium</i>	<i>High</i>	<i>High</i>	<i>High</i>
Correlation Level: <i>Low Medium High</i>							

Mapping of Course Outcomes to Programme Specific Outcomes

	<i>PSO1</i>	<i>PSO2</i>	<i>PSO3</i>	<i>PSO4</i>	<i>PSO5</i>	<i>PSO6</i>	<i>PSO7</i>
<i>CO1</i>	<i>Medium</i>	<i>High</i>	<i>High</i>	<i>High</i>	<i>Medium</i>	<i>High</i>	<i>High</i>
<i>CO2</i>	<i>Medium</i>	<i>High</i>	<i>Medium</i>	<i>High</i>	<i>High</i>	<i>High</i>	<i>High</i>
<i>CO3</i>	<i>Medium</i>	<i>High</i>	<i>High</i>	<i>High</i>	<i>High</i>	<i>High</i>	<i>Medium</i>
<i>CO4</i>	<i>High</i>	<i>High</i>	<i>High</i>	<i>High</i>	<i>High</i>	<i>High</i>	<i>Medium</i>
<i>CO5</i>	<i>Medium</i>	<i>High</i>	<i>High</i>	<i>Medium</i>	<i>Medium</i>	<i>High</i>	<i>High</i>
<i>CO6</i>	<i>High</i>	<i>High</i>	<i>High</i>	<i>High</i>	<i>High</i>	<i>Medium</i>	<i>High</i>
Correlation Level: <i>LowMediumHigh</i>							

46. INDEX NUMBERS

Course Code	TITLE OF THE COURSE	L	T	P	C
Core	INDEX NUMBERS	4	1	0	4
Prerequisites	Basic knowledge of index numbers	Syllabus Version		2024-25	

L: Lecture T: Tutorial P: Practical C: Credits

Course Objectives:

The main objectives of this course are to

- On successful completion of this course, students will be able to acquire the knowledge of index number and its applications.
- To compute the different index numbers in real life problems.
- To analyse the importance of a good index number.

Course Outcomes (COs):

At the end of this course of study, the student will be able to

CO No.	Course Outcome	Cognitive Level
CO1	Provide the basic knowledge in Index number and its types	K1, K2
CO2	Analyse and understand the Price relatives method and Weighted Index Numbers	K1,K2
CO3	Evaluate the test for adequacy of Index number	K5
CO4	Describe and explore the Construction of Weighted Averages	K2-K5
CO5	Apply the analyse the Price and Quantity index number	K3-K5
CO6	To do numerical problems and able to get critical thinking to solve problems To explore real life problems	K1-K6

K1: Remember**K2: Understand****K3: Apply****K4: Analyze****K5: Evaluate****K6: Create**

Course Outline:

Unit-I

Index Numbers Definition, Uses, Types, Problems involved in the construction of Index Numbers – Construction of Index Numbers.

Unit -II

Simple aggregate method and Simple average of Price relatives method. Weighted Index Numbers – Laspeyre's, Paasche's, Dorbish Bowley's, Marshall Edge worth's Index Numbers and Fisher's Ideal Index Number.

Unit -III

Tests for adequacy -Time Reversal Test, Factor Reversal Test, Unit test and Cyclic test. Definition of Deflation, Splicing, Inflation, and Real wages.

Unit -IV

Construction of Weighted Average of Price relatives Index Numbers using A.M & G.M. Fixed Base Index Numbers and Chain Base Index Numbers.

Unit -V

Price and Quantity index numbers – Consumer Price index(CPI) – Producer Price Index (PPI) – Wholesale Price Index – Retail Price Index (RPI) – Production index – Sales index – Export and import index – Employability index.

UNIT VI

Contemporary Issues: Expert lectures, online seminars – webinars. [2 hours]

BOOKS FOR STUDY:

1. Gupta, S.C. and Kapoor, V.K.: Fundamentals of Applied Statistics, Sultan Chand & Co., 4 th Revised Edition, 2019.
2. B.L Agarwal –Basics statistics(Sixth Edition), New age International Publishers.

BOOKS FOR REFERENCE:

1. Garret, H.E., Education and Psychological Statistics, Paragan International Publications, 2005.
2. Pillai RSN and Bagavathi V, Statistics, S. Chand & Co., 2010.

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

1. <https://epgp.inflibnet.ac.in/ahl.php?csrno=34>, P-10. Stochastic Processes and Time Series Analysis.
2. <https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=+u3y6UdbIvOJ97LFeSCmHQ==> P-10. Statistical processes and time series analysis.

Mapping of Course Outcomes to Programme Outcomes

	<i>PO1</i>	<i>PO2</i>	<i>PO3</i>	<i>PO4</i>	<i>PO5</i>	<i>PO6</i>	<i>PO7</i>
<i>CO1</i>	<i>High</i>	<i>High</i>	<i>Medium</i>	<i>Medium</i>	<i>Medium</i>	<i>High</i>	<i>Medium</i>
<i>CO2</i>	<i>High</i>	<i>High</i>	<i>High</i>	<i>High</i>	<i>Medium</i>	<i>High</i>	<i>Medium</i>
<i>CO3</i>	<i>High</i>	<i>High</i>	<i>High</i>	<i>Medium</i>	<i>High</i>	<i>High</i>	<i>Medium</i>
<i>CO4</i>	<i>High</i>	<i>High</i>	<i>High</i>	<i>Medium</i>	<i>High</i>	<i>High</i>	<i>High</i>
<i>CO5</i>	<i>High</i>	<i>High</i>	<i>Medium</i>	<i>Medium</i>	<i>Medium</i>	<i>High</i>	<i>High</i>
<i>CO6</i>	<i>High</i>	<i>Medium</i>	<i>High</i>	<i>Medium</i>	<i>High</i>	<i>High</i>	<i>High</i>
Correlation Level: Low Medium High							

Mapping of Course Outcomes to Programme Specific Outcomes

	<i>PSO1</i>	<i>PSO2</i>	<i>PSO3</i>	<i>PSO4</i>	<i>PSO5</i>	<i>PSO6</i>	<i>PSO7</i>
<i>CO1</i>	<i>Medium</i>	<i>High</i>	<i>High</i>	<i>High</i>	<i>Medium</i>	<i>High</i>	<i>High</i>
<i>CO2</i>	<i>Medium</i>	<i>High</i>	<i>Medium</i>	<i>High</i>	<i>High</i>	<i>High</i>	<i>High</i>
<i>CO3</i>	<i>Medium</i>	<i>High</i>	<i>High</i>	<i>High</i>	<i>High</i>	<i>High</i>	<i>Medium</i>
<i>CO4</i>	<i>High</i>	<i>High</i>	<i>High</i>	<i>High</i>	<i>High</i>	<i>High</i>	<i>Medium</i>
<i>CO5</i>	<i>Medium</i>	<i>High</i>	<i>High</i>	<i>Medium</i>	<i>Medium</i>	<i>High</i>	<i>High</i>
<i>CO6</i>	<i>High</i>	<i>High</i>	<i>High</i>	<i>High</i>	<i>High</i>	<i>Medium</i>	<i>High</i>
Correlation Level: LowMediumHigh							

47. NANN MUDHALVAN

48. EXTENSION ACTIVITY

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