

Estd: 1966

SARASWATHI NARAYANAN COLLEGE

(An Autonomous Institution Affiliated to Madurai Kamaraj University)

(Reaccredited with Grade 'B' by NAAC)

Perungudi, MADURAI – 625 022.

Website : www.sncollegemadurai.org

E.mail: sncollegemdu@yahoo.com

Ph.: 0452 2690635 Fax: 0452 2690635



DEPARTMENT OF STATISTICS

Choice Based Credit System (CBCS)

Learning Outcomes-based Curriculum Framework (LOCF)

M.Sc. Statistics Programme

(For those who join in June 2022)

PRINCIPAL

Dr. M. Kannan M.A., M.Phil., Ph.D.,

DEPARTMENT OF STATISTICS

1. Mr. M. Rajaram, M.Sc., M.Phil.,
- Assistant Professor and Head
2. Mr. Y. Immanuel Nelson, M.Sc., M.Phil.,
- Assistant Professor
3. Mr. L. Ramkumar, M.Sc.,
- Assistant Professor

PROFILE OF THE COLLEGE

Thiru. L. Narayanan Chettiar, a renowned philanthropist founded Saraswathi Narayanan College at Perungudi near Madurai Airport in the year 1966. The college is a prestigious academic powerhouse catering to the educational needs of students hailing from economically weaker and socially oppressed section of our society. It imparts education of the highest quality to students irrespective of caste, creed and religion. The guiding principles of our college are duty, devotion and distinction. The institution has proved an innovative leader and a catalyst in the best educational, cultural and economic interests of students. It is committed to make the students morally upright, intellectually resourceful, socially advantaged and globally competent. It is devoted to teaching, research and extension activities with equal importance.

The college set off its academic journey with Pre-University Courses in the year 1966 – 67. The Institution started offering UG programmes from the academic year 1968 – 69. It was upgraded as Post-Graduate Institution in 1979 – 80 and as Research Institution in 1984 – 85. The co-educational system was introduced for M.Phil. programmes in the academic year 2001 – 02 and for PG programmes in the year 2002 – 03 with the noble objective of promoting higher education among girls in rural areas. Girls have been enrolled in UG programmes also since the academic year 2010 – 11.

The green campus of 66 acres has a built-up area of 1,70,059 sq.ft. A new library housed at Silver Jubilee building was built at the cost of Rs.25,00,000/- and it was inaugurated by His Excellency Dr. M. Chenna Reddy, then the Governor of Tamilnadu on 04.04.1994. The library was dedicated to the memory of Achi. The major donor of this building was Tmt. Saraswathi Narayanan, the better half of the Founder President Thiru. L. Narayanan Chettiar. Sri Vidhya Ganapathi Temple was built and consecrated on 27.08.2015.

The Departments of Botany, Mathematics, Commerce, English, Economics and Chemistry have been upgraded as university recognized research centres to carryout M.Phil and Ph.D research programmes in the college. NAAC accredited the college with grade B+ in the year 2005. UGC accorded the status of Autonomy to our institution in the year 2007. NAAC re-accredited the college with grade B (CGPA of 2.78) in the year 2016. UGC extended the Status of Autonomy to the institution for another period of five years from the academic year 2016 – 17.

M.Sc. STATISTICS – COURSE STRUCTURE

SEMESTER I									
Course type	Title of the Course	Course Code	H / W	Credit	Add. Credit	Exam Hrs.	CIA	Ext	Total
CC-1	Real Analysis and Linear Algebra	LPSTCT11	5	4	-	3	25	75	100
CC-2	Measure and Probability Theory	LPSTCT12	5	4	-	3	25	75	100
CC-3	Advanced Distribution Theory	LPSTCT13	5	4	-	3	25	75	100
CC-4	Practical for Data Analysis Using Excel	LPSTCL11	5	2	-	3	40	60	100
CC-5	Statistical Practical – I	LPSTCL12	5	2	-	3	40	60	100
DSE-1	Time Series Analysis	LPSTDS1 1	5	4	-	3	25	75	100
DSE-1	Robust Statistics	LPSTDS1 2							
Ad. Cr. Co: MOOC	MOOC-1		-	-	-	-	-	-	-
			30	20					

SEMESTER II									
Course type	Title of the Course	Course Code	H /W	Credit	Addl. Credit	Exam Hrs.	CIA	Ext	Total
CC-6	Statistical Estimation Theory	LPSTCT21	5	4	-	3	25	75	100
CC-7	Sampling Techniques	LPSTCT22	5	4	-	3	25	75	100
CC-8	Stochastic Processes	LPSTCT23	5	4	-	3	25	75	100
CC-9	Practical for Data Analysis Using SPSS	LPSTCL21	5	2	-	3	40	60	100
CC-10	Statistical Practical – II	LPSTCL22	5	2	-	3	40	60	100
DSE-2A	Demography	LPSTDS21	3	3	-	3	25	75	100
DSE-2B	Data Mining	LPSTDS22							
AEC-1	Actuarial Statistics	LPSTAE21	2	2	-	3	25	75	100
SLC-1A	Statistical Data Analysis with Python	LPSTSC21	-	-	2	3	100	-	100
SLC-1B	Order Statistics	LPSTSC22							
Ad. Cr. Co: MOOC	MOOC-1		-	-	-	-	-	-	-
			30	21					

SEMESTER III									
Course type	Title of the Course	Course Code	H /W	Credit	Addl. Credit	Exam Hrs.	CIA	Ext.	Total
CC-11	Testing Statistical Hypotheses	LPSTCT31	5	5	-	3	25	75	100
CC-12	Multivariate Statistical Analysis	LPSTCT32	5	5	-	3	25	75	100
CC-13	Statistical Quality Control and Reliability	LPSTCT33	5	5	-	3	25	75	100
CC-14	Practical for Programming in Python	LPSTCL31	4	2	-	3	40	60	100
CC-15	Project and Viva-Voce/Dissertation	LPSTPJ41	4	-	-	3	50 (p)	50 (v)	100
GEC-1	Statistical Methods (NME)	LPSTNM31	5	4	-	3	25	75	100
AEC-2	Statistics for SET/NET Examinations	LPSTAE31	2	2	-	3	25	75	100
SLC-2A	Statistical Data Analysis with R	LPSTSC31	-	-	2	3	100	-	100
SLC-2B	Fundamentals of Data Science	LPSTSC32							
Ad. Cr.Co: MOOC	MOOC-2		-	-	-	-	-	-	-
			30	23					

SEMESTER IV									
Course type	Title of the Course	Course Code	H/W	Credit	Add. Credit	Exam Hrs.	CIA	Ext.	Total
CC-16	Linear Models and Design of Experiments	LPSTCT41	5	5	-	3	25	75	100
CC-17	Advanced Operations Research	LPSTCT42	5	5	-	3	25	75	100
CC-18	Econometrics	LPSTCT43	5	5	-	3	25	75	100
CC-19	Practical for R Programming	LPSTCL41	5	2	-	3	40	60	100
CC-15	Project and Viva-Voce/ Dissertation	LPSTPJ41	4	4	-	3	50 (p)	50 (vv)	100
DSE-3A	Statistical Practical – III & IV	LPSTDS41	4	3	-	3	40	60	100
DSE-3B	Practical for Visual Basic Programming	LPSTDS42							
SEC-1A	Bio-Statistics	LPSTSE41	2	2	-	3	25	75	100
SEC-1B	Survey Analysis	LPSTSE42							
Ad. Cr. Co: MOOC	MOOC-2		-	-	-	-	-	-	-
			30	26					

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DEPARTMENT OF STATISTICS – PG (SF) – CBCS – LOCF

Title of the Course: Real Analysis and Linear Algebra	Semester: I
Course Code: LPSTCT11	Contact Hours: 5
	Credits: 4

Course Learning Outcomes:

On completion of the course, the students are able to

- describe fundamental properties of the real numbers that lead to the formal development of real analysis.
- examine the convergence of sequence and series of real numbers.
- understand the functions are continuous and discontinuous of a real value function.
- explain the fundamental concepts of linear algebra and their role in modern mathematics and applied contexts.
- apply problem-solving using linear algebraic techniques applied to diverse situations in physics, engineering and other mathematical.

Pre Required Knowledge:

- ✓ To enable the students to learn the basic concept of real analysis.
- ✓ Techniques in analysis to well prepared for the advanced courses.
- ✓ The objective of this course is to develop a strong foundation in linear algebra.

Unit I: Basic Topology

Metric Spaces – Compact Sets.

Unit II: Numerical Sequences and Series

Convergent Sequences – Subsequences – Cauchy Sequences – Upper and Lower limits.

Unit III: Continuity

Limits of Functions – Continuous Functions – Continuity and Compactness.

Unit IV: Vector Spaces

Elementary basic concepts – Linear independence and bases – Dual Spaces – InnerProduct Spaces.

Unit V: Linear Transformations

The Algebra of Linear Transformations – Characteristic Roots – Matrices –Determinants.

Suggested Topics for Group Discussion/ Presentation

- ✓ Compact Sets.
- ✓ Upper and Lower limits.
- ✓ Continuous Function.
- ✓ Inner Product space.
- ✓ Matrices.

Suggested Readings:

i) Text Books:

1. Walter Rudin, Principles of Mathematical Analysis, Third Edition, McGraw HillEducation (India) Private Limited, New Delhi, 2013.
Unit I : Chapter 2 : Sections 2.15 to 2.42
Unit II : Chapter 3 : Sections 3.1 to 3.19
Unit III :Chapter 4 : Sections 4.1 to 4.20
2. I. N. Herstein, Topics in Algebra, Second Edition, John Wiley and Sons, 2012.
Unit IV : Chapter 4 : Sections 4.1 to 4.4
Unit V : Chapter 6 : Sections 6.1 to 6.3 & 6.9

ii) Reference Books:

1. T. M. Apostol, Mathematical Analysis, Narosa,New Delhi, 1997.
2. D. Somasundaram, Mathematical Analysis, Narosa, New Delhi, 2002.
3. K. E. Datta, Matrix and Linear Algebra, Prentice-Hall, New Delhi, 1991.

iii) Web Sources:

1. <https://www.math.uci.edu/~gpatrick/source/205b06/chapviii.pdf>
2. <https://imai.fas.harvard.edu/teaching/files/Sequences.pdf>
3. <https://fsw01.bcc.cuny.edu/jorge.pineiro/Lecture%2013.pdf>
4. <http://www.math.iitb.ac.in/~ars/MA106/week6.pdf>
5. https://www.math.tamu.edu/~dallen/linear_algebra/chpt4.pdf

Title of the Course: Measure and Probability Theory Semester: I

Course Code: LPSTCT12 Contact Hours: 5 Credits: 4

Course Learning Outcomes:

On completion of this course, the students will be able to

- apply the general principles of measure theory in such concrete subjects as the theory of probability or financial mathematics.
- develop problem-solving techniques needed to accurately calculate probabilities.
- understand knowledge related to concept of discrete and continuous random variable and their probability distribution including expectation and moments.
- develop the concept of a random sequence and distinguish between different types of convergence for random sequences.
- extend the concept of a random variable to a random process and understand the basics of random processes.

Pre – Required Knowledge:

- ✓ Basic set theory properties, Functions and Inverse Functions.
- ✓ Fundamental concept of random variables and probability.
- ✓ Fundamental ideas about Distribution Function and Mathematical Expectation.

Unit I: Measure on the Real Line

Lebesgue Outer Measure – Measurable Sets – Regularity
– Measurable Functions – Borel and Lebesgue Measurability.

Unit II: Random Variables and Probability Space

Random variables – Functions and inverse functions –
Random variables – Limits of random variables complements
and problem – Probability space – definition of Probability –
simple properties – Discrete Probability space – general
probability space – Induced Probability space.

Unit III: Distribution Function and Expectation

Distribution function – Distribution function of Random
variables – Distribution function of vector Random variables
– Correspondence theorem – Complements and problems –
Definition of Expectation – Properties of Expectations.

Unit IV: Convergence of Random Variables

Convergence of random variables convergence in
probability – Convergence indistribution – Convergence in rth
mean convergence theorem for expectations – Fubini's
theorem.

Unit V: Independence

Definitions – Multiplication Properties – Zero-one Laws –
Laws of Large number Convergence of a Series of
Independent Random Variables – Kolmogorov Inequalities
and A.S. Convergence – Stability of Independent Random
Variables.

Suggested Topics for Group Discussion/ Presentation

- ✓ Measurable functions.
- ✓ Probability Space and Simple Properties.
- ✓ Expectation and its Properties.
- ✓ Convergence in distribution.
- ✓ Stability of Independent Random Variables.

Suggested Readings:

i) Text Books:

1. G. de Barra, Measure Theory and Integration, Second
Edition, New Age International (P) Limited, Publishers,

New Delhi, 2014.

Unit I : Chapter 2 : Sections 2.1 to 2.5

2. B. R. Bhat, Modern Probability Theory an Introductory, Fourth Edition, New Age, International Publishers, New Delhi, 2016.

Unit II : Chapter 2 Chapter 3

Unit III : Chapter 4 Chapter 5

: Sections 2.1 to 2.3

: Sections 3.1 to 3.5

: Sections 4.1 to 4.4

: Sections 5.1, 5.2

Unit IV : Chapter 6 : Sections 6.1 to 6.6

Unit V : Chapter 9 : Chapter 10

: Sections 9.1 to 9.3

: Sections 10.1 to 10.3

ii) Reference Books :

1. J. L Doob, Measure Theory, Springer International Edition, 2010.
2. Y. S. Chow and H. Teicher, Probability Theory, Springer, 1979
3. S. I. Resnick, A Probability Path, 3rd Edition, Springer, 2001.

iii) Web Sources:

1. https://www.math.ucdavis.edu/~hunter/measure_theory/measure_theory.html
2. https://www.youtube.com/watch?v=lgZJohjjs10&list=PLgMDNELGJ1CYKDzKdG_cM1-kuH_a1NCfQA
3. <https://www.youtube.com/watch?v=wjmt7QWvvg8g>
4. https://www.youtube.com/watch?v=V3iEsLPAD68&list=PLU6SqdYcYsflaokdZTm_ptaf-PK7s-B0ju
5. <https://www.youtube.com/watch?v=-cUfm0cPFs>

Title of the Course: Advanced Distribution Theory	Semester: I
Course Code: LPSTCT13	Contact Hours: 5
	Credits: 4

Course Learning Outcomes:

On completion of the course, the students are able to

- understand the equipping with essential tools for statistical analyses of the distributions.
- analysis the importance of probability distribution of random variables and to know the notion of non-central tendency.
- apply the discrete and continuous random variables and their probability distributions and their applications in real life problems.
- develop the properties of compound distributions.
- important distributions of random variables frequently used in order statistics.

Pre Required Knowledge:

- ✓ The basic concepts of mean, median and mode.
- ✓ Basic knowledge of continuous and discrete types.
- ✓ Fundamental of some distributions.

Unit I: Theoretical Continuous Distributions

Log-normal distribution – Gamma distribution – Beta distribution of first kind – Beta distribution of second kind – The exponential distribution.

Unit II: Bivariate Normal Distributions

Laplace double exponential distribution – Weibul distribution – Logistic distribution – Cauchy distribution – Bivariate normal distribution – Conditional distribution.

Unit III: Exact Sampling Distributions

Non-central t-distribution – F-statistic – Non-central F-distribution – Fisher's Z- distribution – Fisher's Z-transformation.

Unit IV: Compound Distributions

Compound distribution – Compound Binomial distribution – Compound Poisson distribution – Pearson's distributions – Variate transformations.

Unit V: Order Statistics

Order statistics – Cumulative distribution function of a single order statistic – Probability density function of a single order statistic – Joint probability density function of two order statistics – Joint probability density function of k-order statistics – Joint probability density function of all n-order statistics – Truncated distribution.

Suggested Topics for Group Discussion/ Presentation

- ✓ Beta distribution of second kind.
- ✓ Logistic distribution.
- ✓ Non-central F-distribution.
- ✓ Compound Binomial distribution.
- ✓ Probability density functions of a single order statistic.

Suggested Readings:

i) Text Book:

1. S. C. Gupta and V. K. Kapoor, Fundamentals of Mathematical Statistics, Ninth Edition, Sultan Chand and Sons, Educational Publishers, New Delhi, 1999.

Unit I : Chapter 8 : Sections 8.2.15 to 8.6.1

Unit II : Chapter 8 : Chapter 10

: Sections 8.7 to 8.9.2

: Sections 10.10 to 10.10.3

Unit III : Chapter 14 : Sections 14.4 to 14.8

Unit IV : Chapter 8 : Sections 8.11 to 8.13.5

Unit V : Chapter 8 : Sections 8.14, 8.15

ii) Reference Books:

1. Rober V. Hogg, Joeseeph Mckean and Allen T. Craig, Introduction to Mathematical Statistics, Seventh Edition, Pearson Education, 2014.

2. A. M. Mood, F. A. Gray Bill and D. C. Boes, Introduction to the Theory of Statistics, Tata Mcgraw-Hill Publication, Third Edition 2005.
3. Parimal Mukhopadhyay, Mathematical Statistics, Books and Allied (P) Ltd, Kolkata-2016.

iii) Web Sources:

1. https://en.wikipedia.org/wiki/Exponential_distribution
2. https://edurev.in/studytube/LECTURE-28-CONDITIONAL-DISTRIBUTIONS-Notes--Engine/13111c9e-69b2-4fe4-b45a-0ce0869effc9_p
3. <https://www.real-statistics.com/students-t-distribution/noncentral-t-distribution/>
4. <https://www.youtube.com/watch?v=8MpgZJHcB8w>
5. <http://parker.ad.siu.edu/Olive/ch4.pdf>

Title of the Course: Practical for Data Analysis Using Excel Semester: I

Course Code: LPSTCL11

Contact Hours: 5

Credits: 2

Course Learning Outcomes:

On completion of the course, the students are able to

- prepare spreadsheets as a collection of information distributed in columns and rows enhance
- the possibility of making calculation in a faster and more accurate way using data analysis.
- understand the meaning behind the number, text and formula can be put together and presented in a fancy and attractive manner so it could be easy.
- perform statistical tests.
- easily draw the various charts.

List of Programs:

1. Descriptive statistics using MS – Excel.
2. Find k largest and smallest number MS – Excel.
3. Find standard deviation and standard error from the given data.

4. Find interior mean from the given data.
5. Perform Correlation and find the coefficient through syntax and data analysis option.
6. Perform regression analysis and find the equation of regression.
7. Perform t-test (paired sample) through syntax and data analysis option.
8. Perform t-test (equal variance) through syntax and data analysis option.
9. Find the slope of regression and draw the trend line from the given data.
10. Perform one-way ANOVA using the given data.
11. Chi-square test in Excel.
12. Poisson function in Excel.
13. Binomial function in Excel.

Title of the Course: Statistical Practical – I
(Calculated based)

Semester: I

Course Code: LPSTCL12

Contact Hours: 5

Credits: 2

Course Learning Outcomes:

On completion of the course, the students are able to

- understand the equipping with essential tools for statistical analyses of the Poisson distributions.
- develop the concept of Laplace distributions and their applications in real life problems.
- analysis the properties of normal distributions.
- uses of practical applications of ratio and regression method of estimation.
- apply problem-solving techniques to solving real-world of the sampling.

List of Programs:

i) Advanced Distribution Theory

1. Fitting of Log-normal distribution.
2. Fitting of Logistic distribution.

3. Fitting of Laplace distribution.
4. Fitting of t-test.
5. Fitting of F-test.
6. Fitting of Chi-square test.

ii) Time Series Analysis

1. Method of moving average.
2. Linear trend.
3. Non-linear trend.
4. Autoregressive moving average method.

Title of the Course: Time Series Analysis

Semester: I

Course Code: LPSTDS11 Contact Hours: 5

Credits: 4

Course Learning Outcomes:

On completion of the course, the students are able to

- develop the traditional methods of time series analysis, intended mainly for working with time series data.
- apply the properties of linear predictor operator and apply various linear forecasting techniques.
- understand the differences between stationary process and time series and those specific economic problems.
- explain the principles underlying exponential smoothing as a forecasting method.
- improve forecast with better statistical models based on statistical analysis.

Pre – Required Knowledge:

- ✓ Basics of moving average.
- ✓ Fundamentals about Variance, Covariance and regression.
- ✓ Basic idea about autocorrelation function.

Unit I: Moving Average Processes

Moving average processes – Absolutely summable sequences and Infinite moving averages – An Introduction to autoregressive time series – Difference equations.

Unit II: Autoregressive Processes

The second order autoregressive time series – Alternative representations of autoregressive and moving average processes – Autoregressive moving average time series – Vector processes – Prediction.

Unit III: Stationary Processes

Basic properties – Linear processes – Introduction to autoregressive moving average (ARMA) processes – Properties of the sample mean and autocorrelation function – Forecasting stationary time series.

Unit IV: Autoregressive Moving Average Models

Autoregressive moving average (p, q) processes – The autocorrelation function (ACF) and Partial autocorrelation function (PACF) of an autoregressive moving average (p, q) processes – Forecasting autoregressive moving average processes.

Unit V: Spectral Analysis

Spectral densities – The Periodogram – Time-Invariant linear filters – The spectral density of an autoregressive moving average process.

Suggested Topics for Group Discussion/ Presentation

- ✓ An Introduction to autoregressive time series
- ✓ Autoregressive moving average time series
- ✓ Forecasting stationary time series.
- ✓ Forecasting autoregressive moving average processes.
- ✓ Time-Invariant linear filters.

Suggested Readings

i) Text Books:

1. Wayne A. Fuller, Introduction to Statistical Time Series, Second Edition, A Wiley-Inter science Publication, John Wiley and Sons INC, New York, 1996.
Unit I : Chapter 2 :Sections 2.1 to 2.4
Unit II : Chapter 2 :Sections 2.5 to 2.9
2. Peter J. Brockwell and Richard A. Davis, Introduction to Time Series and Forecasting, Second Edition,

Springer, New York, 2002.

Unit III : Chapter 2 :Sections 2.1 to 2.5

Unit IV : Chapter 3 :Sections 3.1 to 3.3

Unit V : Chapter 4 :Sections 4.1 to 4.4

ii) Reference Books:

1. T. W. Anderson, The Statistical Analysis of Time Series, Wiley, New York, 2011.
2. Parimal Mukhopadhyay, Applied Statistics, Second Edition, Books and Allied (P) Ltd, Reprinted 2018.
3. S. C. Gupta and V. K. Kapoor, Fundamentals of Applied Statistics, 4/e, Sultan Chand and Sons, New Delhi, 2007.

iii) Web Sources:

1. <https://people.stat.sc.edu/wang528/Stat%20720/STAT720%20Notes.pdf>
2. <https://nptel.ac.in/courses/103106123>
3. https://www.youtube.com/watch?v=DVEbZ_FNRg
4. <https://www.youtube.com/watch?v=yBOqUVQ5zzA>
5. <https://www.youtube.com/watch?v=Y8iFJVmSQIk>

Title of the Course: Robust Statistics

Semester: I

Course Code: LPSTDS12 Contact Hours: 5

Credits: 4

Course Learning Outcomes:

On completion of the course, the students are able to

- know various assumptions and estimates of statistical procedures.
- understand the basics of robust statistics in the context of measures of location and scale.
- compute various scale estimates by using robust methods.
- apply the multiparameter problems based on random samples.
- solve real life problems by applying suitable conventional/robust statistical procedures.

Pre Required Knowledge:

- ✓ Basic concepts the types of estimates.
- ✓ Fundamental of estimates of scale.
- ✓ Learning of estimation of matrix.

Unit I: The Basic Types of Estimates

Introduction (General Remarks) – Maximum Likelihood Types Estimates (M-Estimates)– Linear Combinations of Order Statistics (L-Estimates) – Estimates Derived from Rank Tests (R-Estimates) – Asymptotically Efficient M-,L-, and R-Estimates.

Unit II: Asymptotic Minimax Theory for Estimating A Location Parameter

Introduction (General Remarks) – Minimax Bias – Minimax Variance: Preliminaries – Distributions Minimizing Fisher Information – Determinations of F_0 By Variational Methods – Asymptotically Minimax M-Estimates.

Unit III: Scale Estimates

Introduction (General Remarks) – M-Estimates of Scale – L-Estimates of Scale – R- Estimates of Scale – Asymptotically Efficient Scale Estimates – Distributions Minimizing Fisher Information for Scale – Minimax Properties.

Unit IV: Multiparameter problems, in Particular Joint Estimation of Location and Scale

Introduction (General Remarks) – Consistency of M-Estimates – Asymptotic Normality of M-Estimates – Simultaneous M-Estimates of Location and Scale – M-Estimates with Preliminary Estimates of Scale – Quantitative Robustness Properties of Simultaneous Estimates for Location and Scale – The Computation of M-Estimates – Studentizing.

Unit V: Robust Covariance, Correlation Matrices and Robustness of Design

Introduction (General Remarks) – Estimation of Matrix Elements through Robust Variances – Estimation of Matrix Elements through Robust Correlation – Introduction (General

Remarks) – Minimax Global fit – Minimax Slope.

Suggested Topics for Group Discussion/ Presentation

- ✓ Asymptotically Efficient M-, L-, and R-Estimates.
- ✓ Distributions Minimizing Fisher Information.
- ✓ Minimax Properties.
- ✓ Simultaneous M-Estimates of Location and Scale.
- ✓ Minimax Global fit.

Suggested Readings:

i) Text Book:

1. Peter J. Huber, Robust Statistics, First Edition, John Wiley and Sons, New York, 1981.

Unit I	:	Chapter 3:	Sections 3.1 to 3.5
Unit II	:	Chapter 4:	Sections 4.1 – 4.6
Unit III	:	Chapter 5:	Sections 5.1 – 5.7
Unit IV	:	Chapter 6:	Sections 6.1 to 6.8
Unit V	:	Chapter 8	Chapter 9
	:		Sections 8.1 to 8.3
	:		Sections 9.1 to 9.3

ii) Reference Books:

1. Jana Jureckova and Jan Picek, Robust Statistical Methods with R, Chapman Hall/CRC, 2006.
2. R. R. Wilcox, Fundamentals of Modern Statistical Methods, Springer, 2010.
3. R. R. Wilcox, Introduction to Robust Estimation and Hypothesis Testing, Elsevier, 2017.

iii) Web Sources:

1. <https://www.youtube.com/watch?v=pvvoK4rlzqQ>
2. <https://nptel.ac.in/courses/111105043/>
3. <https://archive.nptel.ac.in/courses/111/105/111105043/>
4. <https://arxiv.org/pdf/2103.07198>
5. <http://parker.ad.siu.edu/Olive/pprcca.pdf>

Title of the Course: Statistical Estimation Theory	Semester: II
Course Code: LPSTCT21	Contact Hours: 5 Credits: 4

Course Learning Outcomes:

On completion of this course, the students will be able to

- understand the most common distributions and the exponential family.
- develop the concept of sufficiency and the likelihood principle.
- understand the most important estimation methods like maximum likelihood, least square and the method of moments.
- construct minimal sufficient statistic and minimal sufficient statistic for exponential family.
- apply the properties of point estimator such consistency, unbiasedness, sufficiency.

Pre – Required Knowledge:

- ✓ Fundamental concepts of probability theory and completeness.
- ✓ Basic Concepts of variance and Moments.
- ✓ Fundamentals of Chi-square Distribution and Method of least square.

Unit I: Point Estimation – Unbiasedness and Consistency

Introduction – Point Estimation – Highest Concentration Criterion – Minimum Mean Square Error Criterion – Unbiased Estimators – Quenoulli's Method of Reducing the Bias in Stages – Consistent Estimators.

Unit II: Sufficiency and Completeness

Introduction – Sufficient Statistics – Fisher's Information Measure – Minimal Sufficient Statistics – Complete Statistics – Exponential Families of Distributions.

Unit III: Minimum Variance Unbiased Estimators

Introduction – Case of a Single Parameter – Lower Bounds for Variance of Unbiased Estimators – Use of Sufficient and Complete Statistics.

Unit IV: Methods of Estimation

Introduction – Method of Moments – Method of Maximum Likelihood – Properties of the Maximum Likelihood Estimators.

Unit V: Interval Estimation

Introduction – A General Method of Constructing Confidence Intervals – Construction of Shortest Average Width Confidence Intervals (CIs) – Construction of CIs in Large Samples.

Suggested Topics for Group Discussion/ Presentation

- ✓ Consistent Estimators.
- ✓ Exponential Families of Distributions.
- ✓ Use of Sufficient and Complete Statistics.
- ✓ Method of Maximum Likelihood.
- ✓ Construction of CIs in Large Samples.

Suggested Readings:

i) Text Book:

1. M. Rajagopalan and P. Dhanavanthan, Statistical Inference, First Edition, PHI Learning Private Limited, New Delhi, 2012.

Unit I	:	Chapter 2	:	Sections 2.1 to 2.7
Unit II	:	Chapter 3	:	Sections 3.1 to 3.6
Unit III	:	Chapter 4	:	Sections 4.1 to 4.4
Unit IV	:	Chapter 5	:	Sections 5.1 to 5.4
Unit V	:	Chapter 6	:	Sections 6.1 to 6.4

ii) Reference Books:

1. Parimal Mukhopadhyay, Mathematical Statistics, Books and Allied (P) Ltd, 2016.

2. V. K. Rohatgi, Statistical Inference, Wiley Eastern Ltd, 1986.
3. C. R. Rao, Linear Statistical Inference and Its Applications, Wiley Eastern Ltd, 1998.
4. A. Santhakumaran, Probability Models and their Parametric Estimation, K. P. Jambhavanthar, Chennai, 2004.

iii) Web Sources:

1. <https://nptel.ac.in/courses/111/105/111105043/>
2. <https://www.youtube.com/watch?v=f6cV9WplvY4>
3. <https://www.youtube.com/watch?v=9bcmOQTB6FE>
4. <https://www.youtube.com/watch?v=F-zyZbLX6hM>
5. <https://www.youtube.com/watch?v=30ETB2MIV9c>

Title of the Course: Sampling Techniques	Semester: II
Course Code: LPSTCT22	Contact Hours: 5
	Credits: 4

Course Learning Outcomes:

On completion of the course, the students are able to

- understand the enumeration and sample, sampling distribution, non-sampling errors, limitations of sampling etc.
- develop the properties of ratio and regression method of estimation.
- explain and to compare various allocations using stratified random sampling.
- apply problem-solving techniques to solving real-world of the sampling.
- draw a conclusion about the best sampling procedure.

Pre Required Knowledge:

- ✓ Apply simplest tricks in solving problems on sampling techniques.
- ✓ Basic concept of the method of estimation.
- ✓ Basic knowledge of linear Regression Estimator.

Unit I: Ratio Estimator

Methods of Estimation – The ratio Estimate – Approximate Variance of the Ratio Estimate – Estimation of variance from a sample – Confidence limits – Comparison of the Ratio Estimate with Mean per unit – Bias of ratio Estimate – The combined ratio Estimate – Comparison of Combined and Separate estimates – Short-cut computation of Estimated variance– Optimum allocation with a Ratio Estimate – Unbiased Ratio-type Estimates.

Unit II: Regression Estimator

The linear Regression Estimate – Regression Estimate with Pre-assigned b – Regression Estimates when b Is Computed from the sample – Sample Estimate of Variance – Large sample comparison with the Ratio estimate and the Mean per Unit – Accuracy of the Large-Sample Formulae – Bias of the Linear Regression Estimate – Regression Estimates in Stratified Sampling – Regression coefficients Estimated from the sample.

Unit III: Systematic Sampling

Relation to Cluster sampling – Variance of the Estimated Mean – Comparison of systematic with stratified random sampling – Populations in random order – Populations with linear trends – Populations with Periodic Variation – Auto correlated Populations – Natural populations – Estimation of the variance from a Single sample.

Unit IV: Single-stage Cluster Sampling Clusters of Equal Sizes

Reasons for Cluster Sampling – A simple Rule – Comparisons of Precision Made from survey data – Variance in terms of intra cluster correlation – Variance functions – A cost function – Cluster sampling for Proportions.

Unit V: Single-stage Cluster Sampling Clusters of Unequal Sizes

Cluster units of unequal sizes – Sampling with probability proportional to size – selection with unequal probabilities with and without replacement – The optimum measure of

size – Relative Accuracies of three techniques – The Horvitz-Thompson Estimator – Brewer’s Method – Murthy’s Method.

Suggested Topics for Group Discussion/ Presentation

- ✓ Basic concept of the method of estimation.
- ✓ The linear Regression Estimate.
- ✓ Single-Stage Cluster Sampling Clusters of Equal Sizes.
- ✓ A cost function.
- ✓ Brewer’s Method and Murthy’s method.

Suggested Readings:

i) Text Book:

1. William G. Cochran, Sampling Techniques, 3rd Edition, John Wiley and Sons, New York, 2015.
Unit I : Chapter 6 : Sections 6.1 to 6.8, 6.11 to 6.15
Unit II : Chapter 7 : Sections 7.1 to 7.10
Unit III : Chapter 8 : Sections 8.1 to 8.11
Unit IV : Chapter 9 : Sections 9.1 to 9.7
Unit V : Chapter 9A : Sections 9A.1 to 9A.9

ii) Reference Books:

1. S. Sampath, Sampling Theory and Methods, The New Age International Ltd, New Delhi, 2001.
2. P. Mukhopadyay, Survey Sampling, Narosa, New Delhi, 2007.
3. S. Sampath, Sampling Theory and Methods, The new age international ltd. New Delhi, 2001.
4. M. N. Murthy, Sampling Theory and methods, Statistical Publishing Society, Calcutta, 1997.

iii) Web Sources:

1. <https://uca.edu/psychology/files/2013/08/Ch7-Sampling-Techniques.pdf>
2. <https://www.youtube.com/watch?v=be9e-Q-jC-0>
3. http://182.18.165.51/Fac_File/STUDY183@323405.pdf
4. https://www.youtube.com/watch?v=_pc3iHU9vHo

5. <https://nptel.ac.in/content/storage2/courses/111104073/Module6/Lecture20>

Title of the Course: Stochastic Processes **Semester: II**

Course Code: LPSTCT23 **Contact Hours: 5** **Credits: 4**

Course Learning Outcomes:

On completion of the course, the students are able to

- compute n-step transition probability matrix and its long run.
- classify the states of Markov chain.
- inculcate various models of stochastic process and its applications.
- provide of the depth knowledge about renewal processes theory and renewal equation.
- gain knowledge of branching process and real life problems.

Pre Required Knowledge:

- ✓ Basic knowledge of random variables.
- ✓ Fundamental of Markov chains.
- ✓ Understanding the renewal process.

Unit I: Stochastic Processes: Some Notions and Markov Chains

Introduction – Specification of stochastic processes – Stationary processes – Martingales – Markov chains: Definition and examples – Higher transition probabilities.

Unit II: Markov Chains (Continued)

Generalization of Independent Bernoulli Trials : Sequence of Chain- Dependent Trials– Classification of States and Chains – Determination of Higher Transition Probabilities –Stability of a Markov System.

Unit III: Markov Processes with Discrete State Space: Poisson Process and its Extensions

Poisson Process – Poisson Process and Related

Distributions – Generalizations of Poisson Process – Birth and Death Process.

Unit IV: Renewal Processes and Theory

Renewal Process – Renewal Processes in Continuous Time – Renewal Equation – Stopping Time: Wald's Equation – Renewal theorems – Elementary Theorem.

Unit V: Branching Processes

Introduction – Properties of Generating Functions of Branching Processes – Probability of Extinction – Distribution of the total number of Progeny.

Suggested Topics for Group Discussion/ Presentation

- ✓ Stationary processes.
- ✓ Stability of a Markov System.
- ✓ A generalization of Poisson Process, Birth and Death Process.
- ✓ Wald's Equation, Renewal Theorems and Elementary Theorem.
- ✓ Properties of Generating Functions of Branching Processes

Suggested Readings:

i) Text Book:

1. J. Medhi, Stochastic Processes, Second Edition, New Age International (P) Ltd, 2006.

Unit I : Chapter 2 : Sections 2.1 to 2.4

Chapter 3 : Sections 3.1 to 3.2

Unit II : Chapter 3 : Sections 3.3 to 3.6

Unit III : Chapter 4 : Sections 4.1 to 4.4

Unit IV : Chapter 6 : Sections 6.1 to 6.5.1

Unit V : Chapter 9 : Sections 9.1 to 9.4

ii) Reference Books:

1. B. R. Bhat, Stochastic processes, New Age International (P) Ltd, 2002
2. S. M. Ross, Stochastic processes, 2/e, Wiley, New Delhi, 1996.

9. Experimental Design: Two ways ANOVA.
10. Experimental Design: Factorial designs.
11. Experimental Design: Multiple comparison tests.
12. Multivariate: Factor analysis – Principal component analysis.
13. Non-parametric distributions.

Title of the Course: Statistical Practical – II
 (Calculated based)

Semester: II

Course Code: LPSTCL22

Contact Hours: 5

Credits: 2

Course Learning Outcomes:

On completion of the course, the students are able to

- understand the most important estimation methods like maximum likelihood, least square and the method of moments.
- apply the minimal sufficient statistic and minimal sufficient statistic for exponential family.
- analysis the control chart for \bar{a} and R
- apply the various fields and components of average control charts.
- understand the various sampling inspection techniques.

List of Programs

i) Statistical Estimation Theory

1. Estimation of parameters by the methods of moments.
2. Estimation of parameters by the methods of MLE.
3. Minimal Sufficient Statistics.
4. Interval estimation of population parameters.
5. Confidence interval for mean, variance.

ii) Sampling Techniques

1. Ratio Estimator.
2. Estimation of the population total and variance estimation.

3. Regression Estimator.
4. Linear Regression.
5. Cluster Sampling.

Title of the Course: Demography	Semester: II
Course Code: LPSTDS21	Contact Hours: 3
	Credits: 3

Course Learning Outcomes:

On completion of the course, the students are able to

- analyze the concepts of demography and its importance
- develop the methods of demography.
- explore the importance of world population.
- acquire the knowledge of mortality.
- analyze the concepts of migration and its importance.

Pre Required Knowledge:

- ✓ Learn the core idea of demographic.
- ✓ Understanding the population dynamics.
- ✓ Basic knowledge of fertility demography.

Unit I: Scope of Demography

Demography: Definitions, Nature, Aims, Scope and Value – Relationship of demography and other studies.

Unit II: Development of demography

Theories of population – Constituents, Methods and Sources of demographic data.

Unit III: Characteristics of demography

Structure and Characteristics of population – Population Dynamics: Mortality

Unit IV: Migration of demography

Fertility – Migration.

Unit V: Vital Statistics

Measurement of mortality – Mortality table or life table – Abridged life table

Suggested Topics for Group Discussion/ Presentation

- ✓ Definitions, Nature, Aims, Scope and Value.
- ✓ Theories of population.
- ✓ Population Dynamics: Mortality.
- ✓ Fertility.
- ✓ Abridged life table.

Suggested Readings:

i) Text Books:

1. Kumar, Social Demography and Population Studies, Eighth Edition, Lakshmi Narain Agarwal, Educational Publisher, 2014.

S Unit I : Chapter 1, Chapter 2

Unit II : Chapter 3, Chapter 4

Unit III : Chapter 9, Chapter 10

Unit IV : Chapter 11, Chapter 13

2. . C Gupta and V. K. Kapoor, Fundamentals of Applied Statistics, Sultan Chand and Sons (P), New Delhi, 2007.

Unit V : Chapter 9 : Sections 9.4 to 9.6

ii) Reference Books:

1. K. Srinivasan, Basic demographic techniques and applications, Sage, New Delhi, 1997.
2. S. C. Gulati, Fertility in India: an econometric study of metropolis, Sage, New Delhi, 1998.
3. J. L. Simon, Population and development in poor countries, Princeton University Press, 1996.
4. N. Keyfliz and H. Caswell, Applied Mathematical Demography, Springer, New York, 2006.

iii) Web Sources:

1. <https://www.sociologydiscussion.com/demography/demography-meaning-scope-and-importance-sociology/2932>
2. <https://niu.edu.in/sla/online-classes/Theories-of-Population.pdf>

3. https://www.lkouniv.ac.in/site/writereaddata/siteContent/202004032240235577Anupama_Singh_Mortality_and_its_measures.pdf
4. <http://studylecturenotes.com/migration-definition-types-cause-and-examples/>
5. <https://www.measureevaluation.org/resources/training/online-courses-and-resources/non-certificate-courses-and-mini-tutorials/population-analysis-for-planners/lesson-7.html>

Title of the Course: Data Mining

Semester: II

Course Code: LPSTDS22

Contact Hours: 3

Credits: 3

Course Learning Outcomes:

On completion of the course, the students are able to

- analyze the basic functions of data warehouse and data mining.
- get knowledge about database and their structure in social media.
- apply data mining techniques in real world scenario.
- develop case studies on different applications of data mining.
- analyze the computational on types of cluster analysis.

Pre Required Knowledge:

- ✓ Understand the role of separate database for decision making.
- ✓ Learn the core ideas of data mining techniques in different case studies.
- ✓ Apply the cluster analysis of data bases.

Unit I: Data Mining and Data warehousing

Introduction to Data mining – Architecture of data mining – Data mining on what kind of data – Data mining functionalities – Classification of Data mining System – Data mining Techniques –Major Issues in data mining – Introduction to Data warehousing – Data warehouse components – Multidimensional Data model.

Unit II: Data Preprocessing and Concept Description

Data Pre-processing – Data Cleaning – Data Integration – Data Transformation – Data Reduction – What is concept description? – Data Generalization and Summarization-Based Characterization – Mining Class Comparisons – Mining Descriptive Statistical Measures in Large Database Mining data dispersion characteristics.

Unit III: Classification and Prediction – I

Classification and prediction – Issues Regarding Classification and Prediction – Classification by decision Tree Induction – Bayesian classification.

Unit IV: Classification and Prediction – II

Classification by Back propagation – Classification by Association Rules – Other Classification Methods – Prediction – Classifier Accuracy.

Unit V: Cluster Analysis

Cluster Analysis – What is Cluster Analysis – Types of Data in Cluster Analysis – A Categorization of Major Clustering Methods – Partitioning Methods.

Suggested Topics for Group Discussion/ Presentation

- ✓ Data mining Techniques.
- ✓ Data Generalization and Summarization.
- ✓ Classification by decision Tree Induction.
- ✓ Classification by Association Rules.
- ✓ Types of Data in Cluster Analysis.

Suggested Readings:

i) Text Book:

1. B. S. Charulatha, Data Mining and Ware housing, Charulatha Publications, Chennai, 2017.

Unit I : Chapter 1 : Chapter 2
: Sections 1.1 to 1.7 Sections 2.1 to 2.3
Unit II : Chapter 3 : Chapter 4
: Sections 3.1 to 3.5 Sections 4.1 to 4.4

Unit III	: Chapter 6	: Sections 6.1 to 6.4
Unit IV	: Chapter 6	: Sections 6.5 to 6.9
Unit V	: Chapter 7	: Sections 7.1 to 7.4

ii) Reference Books:

1. S. N. Sivanandam and S. Sumathi, Data Mining Concepts, Tasks and Techniques, Springer, New Delhi, 2006.
2. J. A. Berry, and G. S. Linoff, Data Mining Techniques, (3/e), Wiley, New York, 2011.
3. M. H. Dunham, Data Mining: Introductory and Advanced Topics, Pearson, New Delhi, 2006.

iii) Web Sources:

1. <https://lecturenotes.in/subject/32/data-mining-and-data-warehousing-dmdw>
2. <https://youtu.be/J61r--lv7-w>
3. <https://youtu.be/AcRNpG37Q8E>
4. https://www.tutorialspoint.com/data_mining/dm_classification_prediction.htm
5. https://cse.sc.edu/~rose/587/PDF/chap8_basic_cluster_analysis.pdf

Title of the Course: Actuarial Statistics

Semester: II

Course Code: LPSTAE21 Contact Hours: 2

Credits: 2

Course Learning Outcomes:

On completion of the course, the students are able to

- describe fundamental properties of the annuities that lead to the formal development of real actuarial sciences or studies.
- understand the basic concepts and terminologies related to actuarial studies.
- develop of statistical principles and their application in actuarial science.

- explain the fundamental concepts of Stochastic Rate Models and their role in actuarial studies.
- apply problem-solving using Markov chain techniques applied to diverse situations in actuarial studies in real life.

Pre Required Knowledge:

- ✓ Basic concepts of statistical distributions.
- ✓ Basic knowledge of the essential features of statistical distributions.
- ✓ Fundamental of some distributions.

Unit I: Financial Computational Models

Fixed Financial Rate Models – Financial Rate-Based Calculations – General Period Discrete Rate Models – Continuous-Rate Models – Fixed-Rate Annuities: Discrete Annuity – Continuous Annuity Models – Stochastic Rate Models: Discrete Stochastic Rate Model – Continuous Stochastic Rate Models – Discrete Stochastic Annuity Models – Continuous Stochastic Annuity Model.

Unit II: Deterministic Status Models

Basic Loss Model: Deterministic Loss Models – Stochastic Rate Models – Stochastic Loss Criterion: Risk Criteria – Percentile Criteria – Single-Risk Models: Insurance Pricing – Investment Pricing – Options Pricing – Option Pricing Diagnostics.

Unit III: Future Lifetime Random Variables

Continuous Future Lifetime – Discrete Future Lifetime – Force of Mortality – Fractional Ages – Select Future Lifetimes – Survivorship Groups.

Unit IV: Life Tables

Life Models and Life Tables – Life Table Confidence sets and Prediction Intervals – Life Models and Life Table Parameters – Population Parameters – Aggregate parameters – Fractional Age parameters – Select and Ultimate Life Tables.

Unit V: Stochastic Status Models

Stochastic Present Value Functions – Risk Evaluations:
Continuous-Risk Calculations – Discrete Risk Calculations –
Mixed Risk Calculations – Percentile Evaluations: Life
Insurance – Types of Unit Benefit Life Insurance – Life
Annuities –Types of Unit Payment Life Annuities –
Apportionable Annuities.

Suggested Topics for Group Discussion/ Presentation

- ✓ Fixed-Rate Annuities and Discrete Annuity.
- ✓ Single-Risk Models.
- ✓ Force of Mortality.
- ✓ Life Models and Life Tables.
- ✓ Types of Unit Benefit Life Insurance.

Suggested Readings:

i) Text Book:

1. Dale S. Borowiak, Arnold F. Shapiro, Financial and Actuarial Statistic An Introduction, Second Edition, CRC Press Taylor & Francis Group, New York, 2014.

Unit I	:	Chapter 3	:	Sections 3.1 to 3.3
Unit II	:	Chapter 4	:	Sections 4.1 to 4.3
Unit III	:	Chapter 5	:	Sections 5.1 to 5.6
Unit IV	:	Chapter 5	:	Sections 5.7 to 5.10
Unit V	:	Chapter 6	:	Sections 6.1 to 6.5

ii) Reference Books:

1. G. W. Barclay Techniques of Population Analysis, Wiley, New York, 1970.
2. D.W.A.Donald, Compound Interest and Annuities-certain, For The Institute of Actuaries and the Faculty of Actuaries at the University Press, 1970.
3. E.T.Spurgeon, Life Contingencies, Cambridge University Press, Cambridge, 2011.
4. P.F.Hooker, L.H Cook Longley, Life and other contingencies, Cambridge, 1957.

iii) Web Sources:

1. <https://www.youtube.com/watch?v=4Sk92AIKLSg>
2. <https://www.youtube.com/watch?v=cTxaGkN2CxA>
3. <http://www.math.umd.edu/~evs/s470/BookChaps/ActuChp3.pdf>
4. https://www.youtube.com/watch?v=5n_JBf-9ohA
5. https://www.youtube.com/watch?v=m_BspKtRTJs

Title of the Course: Statistical Data Analysis with Python Semester: II
Course Code: LPSTSC21 Contact Hours: Self-study Credits: 2

Course Learning Outcomes:

On completion of the course, the students are able to

- understand the main features of python data structures.
- apply the statistical techniques in python.
- discuss the distributions of variables..
- analyze of the hypotheses test.
- explain the numerical data.

Unit I: Python

Getting Started – Python Data Structures – IPython/Jupyter: An Interactive Programming Environment – Developing Python Programs – Pandas: Data Structures for Statistics – Statsmodels: Tools for Statistical Modeling – Seaborn: Data Visualization – General Routines.

Unit II: Data Input and Display of Statistical Data

Input from Text Files – Input from MS Excel – Input from Other Formats – Data types – Plotting in Python – Displaying Statistical Datasets.

Unit III: Distributions of One Variable

Characterizing a Distribution – Discrete Distributions – Normal Distribution – Continuous Distributions Derived from the Normal Distribution – Other Continuous Distributions.

Unit IV: Hypothesis Tests

Typical Analysis Procedure – Hypothesis Concept, Errors,

p-Value, and Sample Size – Sensitivity and Specificity – Receiver-Operating-Characteristic (ROC) Curve.

Unit V: Tests of Means of Numerical Data

Distribution of a Sample Mean – Comparison of Two Groups – Comparison of Multiple Groups – Summary: Selecting the Right Test for Comparing Groups.

Suggested Readings:

i) Text Book:

1. Thomas Haslwanter, An introduction to Statistics with Python with Applications in the Life Sciences, First Edition, Springer International Publishing Switzerland, 2016.

Unit I	: Chapter 2	: Sections	2.1 to 2.8
	Chapter 3	: Sections	3.1 to 3.3
Unit II	: Chapter 4	: Sections	4.1 to 4.3
Unit III	: Chapter 6	: Sections	6.1 to 6.5
Unit IV	: Chapter 7	: Sections	7.1 to 7.4
Unit V	: Chapter 8	: Sections	8.1 to 8.4

ii) Reference Books:

1. Eric Matthes, Python Crash Course, Library of Congress Cataloging-in-Publication data,2016.
2. R. Nageswara Rao, Core Python Programming, Dreamtech Press, New Delhi, 2018.
3. J. Chun. Wesley, Core Python Programming, 2/e, Pearson education, 2010.

iii) Web Sources:

1. <https://bedford-computing.co.uk/learning/wp-content/uploads/2015/10/Python-for-Data-Analysis.pdf>
2. <https://www.youtube.com/watch?v=GPVsHOIRBBI>
3. <https://www.datacamp.com/community/tutorials/probability-distributions-python>
4. <https://www.analyticsvidhya.com/blog/2020/07/hypothesis-testing-68351/>

5. <https://www.youtube.com/watch?v=NphgfkeiEPw>

Title of the Course: Order Statistics

Semester: II

Course Code: LPSTSC22

Contact Hours: Self-study

Credits: 2

Course Learning Outcomes:

On completion of the course, the students are able to

- understand the various property of Order statistics.
- apply the Order statistics of various types of discrete distribution and articulate their properties.
- explain the different distribution used in order statistics.
- analyze the properties and relations of moments of Order statistics.
- explain the estimation and prediction under order statistics.

Unit I: Introduction and Basic Distribution Theory

Order Statistics – Here, There and Everywhere – Introduction – Distribution of an Order Statistics – Joint Distribution of Two Order Statistics – Some Properties of Order Statistics – Some Properties of Order Statistics – Distribution of the Median, Range, and Some other Statistics.

Unit II: Discrete Order Statistics

Introduction – Single Order Statistic – Joint Probability mass Function – Dependence Structure – Distribution of the Range – Geometric Order Statistics – Order Statistics from a Without-Replacement Sample – Introduction – Bernoulli Distribution – Three-Point Distribution.

Unit III: Order Statistics Some Specific Distribution

Binomial Distribution – Poisson Distribution – Exponential Distribution – Uniform Distribution – Logistic Distribution – Normal Distribution – Computer Simulation of Order Statistics.

Unit IV: Moment Relations, Bounds, Approximations and Characterization Using order Statistics

Introduction – Basic Formulas – Some Identities and Recurrence Relations – Universal Bounds – Who Cares? -

The Distribution of an Order Statistics Determines the Parent Distributions – Characterizations Based on Moments of Order Statistics – Characterizations Based on Distributional Relationships among Order Statistics – Characterizations Involving Dependency Assumptions - Characterizations Involving Samples of Random Size.

Unit V: Order Statistics in Statistical Inference

Introduction – Types of Order Statistics Data – Order Statistics and Sufficiency – Maximum-Likelihood Estimation – Linear Estimation of Location and Scale Parameters – Prediction of Order Statistics – Distribution-Free Confidence and Tolerance Intervals – Goodness-of-Fit Tests.

Suggested Readings:

i) Text Book:

1. Barry C. Arnold, N. Balakrishnan, and H. N. Nagaraja, A First Course in Order Statistics, First Edition, Published by John Wiley and Sons, 1992.

Unit I	:	Chapter 1	Chapter 2
Unit II	:	Chapter 3	Chapter 4
	:	Sections 1.1, 1.2	
	:	Sections 2.1 to 2.5	
	:	Sections 3.1 to 3.7	
	:	Sections 4.1 to 4.3	
Unit III	:	Chapter 4	: Sections 4.4 to 4.10
Unit IV	:	Chapter 5	Chapter 6
	:	Sections 5.1 to 5.4	
	:	Sections 6.1 to 6.6	
Unit V	:	Chapter 7	: Sections 7.1 to 7.8

ii) Reference Books:

1. U. Kamps, A Concept of Generalized Order Statistics, Teubner, Stuttgart, 1995.
2. M. Ahsanullah, and V. B. Nevzorov, Order Random Variables, Nova Science Publishers, Huntington, New York, 2001.

3. A. A. David, and H. N. Nagarajan, Order Statistics, Wiley, Hoboken, 2003.

iii) Web Sources:

1. <https://www.youtube.com/watch?v=d5iAWPnrH6w>
2. https://www.colorado.edu/amath/sites/default/files/attached-files/order_stats.pdf
3. http://erepository.uonbi.ac.ke/bitstream/handle/11295/97307/MSc_Project2016.pdf?sequence=1&isAllowed=y
4. <http://ijmcs.future-in-tech.net/16.4/R-YousefAlharbi.pdf>
5. <https://home.iitk.ac.in/~kundu/prediction-weibull-raqab.pdf>

Title of the Course: Testing Statistical Hypotheses	Semester: III
Course Code: LPSTCT31	Contact Hours: 5
	Credits: 5

Course Learning Outcomes:

On completion of the course, the students are able to

- understand the inferences about statistical unknown population parameters based on random samples.
- gain knowledge of the test statistical hypothesis by selecting suitable test procedure.
- apply the parametric hypothesis testing problem and to use the likelihood ratio method.
- solve real life problems by applying suitable non-parametric testing procedure.
- determine the sequential estimation and the SPRT.

Pre Required Knowledge:

- ✓ Basic knowledge on statistical hypothesis.
- ✓ Understanding the difference between parametric and non-parametric.
- ✓ Fundamental ideas of the sequential probability ratio test.

Unit I: Testing Statistical Hypotheses – I

Introduction – Neyman-Pearson Theory – Test Functions or Critical Functions – Most Powerful Tests when H and K are Simple – Most powerful Randomized Tests – Uniformly Most Powerful Tests – Monotone Likelihood Ratio Property.

Unit II: Testing Statistical Hypotheses – II

Introduction – Generalized Neyman-Pearson (GNP) Lemma – Tests for One Parameter Exponential Family of Distributions – Locally Most Powerful Tests – UMPU Tests for Multi- Parameter Exponential Family of Distributions.

Unit III: Likelihood Ratio Methods of Test Construction

Introduction – Likelihood Ratio Test – Asymptotic Distribution of the LR test Criterion – Likelihood Ratio Test for Categorized Data – Test Consistency.

Unit IV: Nonparametric Methods

Introduction – Nonparametric Estimation – Empirical Distribution Function – U-Statistics – Nonparametric Tests – Single Sample Problems – Two Sample Problems – K-Sample Problems.

Unit V: Sequential Procedures

Introduction – Sequential Estimation – Sequential Hypothesis Testing – Sequential Probability Ratio Test – Determination of the Constants B and A for the SPRT – OC and ASN Functions of the SPRT – Certain Basic Results for SPRT – SPRTs when the Hypotheses are Composite.

Suggested Topics for Group Discussion/ Presentation

- ✓ Most powerful Randomized Tests.
- ✓ Generalized Neyman-Pearson Lemma.
- ✓ Likelihood Ratio Test.
- ✓ Nonparametric Tests.
- ✓ OC and ASN Functions of the SPRT.

Suggested Readings:

i) Text Book:

1. M. Rajagopalan and P. Dhanavanthan, Statistical Inference, First Edition, PHI Learning Private Limited, New Delhi, 2012.

Unit I	: Chapter 7	:	Sections 7.1 to 7.6
Unit II	: Chapter 8	:	Sections 8.1 to 8.5
Unit III	: Chapter 9	:	Sections 9.1 to 9.5
Unit IV	: Chapter 12	:	Sections 12.1 to 12.3

Unit V : Chapter 13 : Sections 13.1 to 13.3

ii) Reference Books:

1. Parimal Mukhopadhyay, Mathematical Statistics, Books and Allied (P) Ltd, 2016.
2. E. L. Lehmann and G. Casella, Testing Statistical Hypotheses, (2/e), Springer, New York, 1998.
3. C. R. Rao, Linear Statistical Inference and its Applications, Wiley Eastern Ltd, 1998.

iii) Web Sources:

1. https://youtu.be/_Qlxt0HmuOo
2. <https://youtu.be/PbKQyZZqSh0>
3. https://youtu.be/Tn5y2i_MqQ8
4. <https://youtu.be/lcLSKko2tsg>
5. <https://youtu.be/L1QHZ--gpAk>

Title of the Course: Multivariate Statistical Analysis Semester: III

Course Code: LPSTCT32 Contact Hours: 5 Credits: 5

Course Learning Outcomes:

On completion of the course, the students are able to

- understand the basic minimum level of matrix competency and with general aspects of handling multivariate data.
- apply the range of multivariate techniques and use multivariate method analyze data with statistical software.
- develop the link between multivariate techniques and corresponding univariate techniques.
- handling of the statistical software in relation to different techniques for multivariate analyses through applications on concrete data.
- know the important theorems and concepts in multivariate analysis

Pre Required Knowledge:

- ✓ Fundamentals of Normal Distribution and its properties.

- ✓ Estimators, correlation coefficient & Covariance Matrix.
- ✓ Basic Concept of classification and maximum likelihood estimator.

Unit I: The Multivariate Normal Distribution

Introduction – Notions of Normal distribution – The Multivariate normal distribution – The distributions of linear combinations of normally distributed variates : Independence of variates : Marginal distributions – Conditional distributions and multiple correlation co-efficient

– The characteristic function : Moments.

Unit II: Estimation of the Mean Vector and the Covariance Matrix

Introduction – The maximum likelihood estimators of the mean vector and the covariance matrix – The distribution of the sample mean vector : Inference concerning the mean when the covariance matrix is known – The distribution and uses of sample correlation co-efficient of bivariate sample.

Unit III: Correlation Co-efficient's and The Generalized T^2 – Statistic

Conditional distributions – The Multiple correlation co-efficient – The Generalized T^2 – Statistic – Introduction – Derivation of the Generalized T^2 – Statistics and its distribution of T^2 under alternative Hypotheses : The power function.

Unit IV: Classification of Observations

The problem of classification – Standards of Good classification – Procedures of classification into one of two populations with known probability distributions – Classification into one of two Multivariate Normal population when the parameters estimated.

Unit V: Principal Components

Introduction – Definition of Principal components in the population – Maximum likelihood estimators of the Principal components and their variances – Computation of the Maximum likelihood estimates of the principal components – Canonical correlations and Canonical variables: Introduction

– Canonical correlations and variates in the population.

Suggested Topics for Group Discussion/ Presentation

- Conditional distributions and multiple correlation coefficient.
- The distribution and uses of sample correlation coefficient of bivariate sample.
- The Multiple correlation co-efficient.
- Classification into one of two Multivariate Normal population when the parameters estimated.
- Canonical correlations and variants in the population.

Suggested Readings

i) Text Book:

1. T. W. Anderson, Introduction to Multivariate Statistical Analysis, Third Edition, A JohnWiley and Sons, Inc., Publication, 2003.

Unit I : Chapter 2 : Sections 2.1 to 2.6

Unit II : Chapter 3 Chapter 4

Unit III : Chapter 4 Chapter 5

: Sections 3.1 to 3.3

: Sections 4.1,4.2

: Sections 4.3, 4.4

: Sections 5.1, 5.2 & 5.4

Unit IV : Chapter 6 : Sections 6.1 to 6.5

Unit V : Chapter 11 : Chapter 12

: Sections 11.1 to 11.4

: Sections 12.1, 12.2

ii) Reference Books:

1. R. A. Johnson and D. W. Wichern, Applied Multivariate Statistical Analysis, Prentice –Hall of India (P) Ltd , New Delhi , 2007.
2. C. R. Rao, Linear Statistical Inference and its Applications, Wiley Eastern Ltd 1998. .

3. D. F. Morrison, Multivariate Statistical Methods, Fourth Edition, Duxbury Press, New York, 2004.

iii) Web Sources:

1. <https://www.youtube.com/watch?v=YgExEVji7xs>
2. <https://www.youtube.com/watch?v=CF9kVoyz8cc>
3. <https://www.youtube.com/watch?v=dbYgmb6rCCA>
4. <https://www.youtube.com/watch?v=lmKKekAyFls>
5. <https://www.youtube.com/watch?v=hkCT-6KJAK0&t=48s>

Title of the Course: Statistical Quality Control and Reliability **Semester: III**

Course Code: LPSTCT33 **Contact Hours: 5** **Credits: 5**

Course Learning Outcomes:

On completion of the course, the students are able to

- develop the concept of control chart for \bar{a} and \bar{R}
- understand the various sampling inspection techniques.
- apply the various fields and components of average control charts.
- provide the depth knowledge about the estimation of process average.
- develop an understanding of the statistics behind reliability engineering models, including parameter estimation and confidence intervals.

Pre Required Knowledge:

- ✓ Basic concepts of the control charts.
- ✓ Use control charts to analyze for improving the process quality.
- ✓ Understand the concepts of statistics in reliability.

Unit I: Control Charts for Variables

Introduction – Control Charts for \bar{a} and \bar{R} – Control Charts for \bar{a} and \bar{R} – The Shewhart control chart for individual measurements.

Unit II: Control Charts for Attributes

Introduction – The Control Chart for Fraction Nonconforming – Control Charts for Nonconformities (Defects) – Choice between attributes and variables control charts.

Unit III: Cumulative Sum and Exponentially Weighted Moving Average Control Charts

The Cumulative Sum Control Chart – The Exponentially Weighted Moving Average Control Chart – The Moving Average Control Chart.

Unit IV: Lot-By-Lot Acceptance Sampling for Attributes

The Acceptance-Sampling Problem – Single-Sampling Plans for Attributes – Double, Multiple, and Sequential Sampling – Military Standard 105E – The Dodge-Romig Sampling Plans.

Unit V: Reliability

Introduction – Quality control and Reliability – Definitions of Reliability – Basic Elements of Reliability – Failure Pattern for Complex Product – Methods for Improving Design Reliability – Measurement of Reliability – Mean Time Between Failures (MTBF) – Mean Time to Repair (MTTR) – Benefits of FMECA – Total Productive Maintenance (TPM) – Hazard Analysis – Reliability of switches.

Suggested Topics for Group Discussion/ Presentation

- ✓ Control Charts for attributes.
- ✓ Control Charts for Nonconformities.
- ✓ The Exponentially Weighted Moving Average Control Chart.
- ✓ Single-Sampling Plans for Attributes.
- ✓ Mean Time Between Failures.

Suggested Readings:

i) Text Books:

1. Douglas C. Montgomery, Introduction to Statistical Quality Control, 6th Edition, John Wiley & Sons, Inc(P),USA, 2009.

- Unit I : Chapter 6 : Sections 6.1 to 6.4
 Unit II : Chapter 7 : Sections 7.1 to 7.4
 Unit III : Chapter 9 : Sections 9.1 to 9.3
 Unit IV : Chapter 15 : Sections 15.1 to 15.5
2. M. S. Mahajan, Statistical Quality Control, 1st Edition
 Dhanpat Rai and Co. (P) Ltd., Educational and
 Technical Publishers, Delhi, 2002.
 Unit V : Chapter 13

ii) Reference Books:

1. T. Burr John, Elementary Statistical Quality Control, Second Edition, Marcel Dekker New York, 2004.
2. Douglas C. Montgomery and George C. Runger, Applied Statistics and Probability for Engineers, John Wiley and sons, New Delhi 2007.
3. S. Zacks, Introduction to Reliability Analysis, Springer Verlag, 1992.

iii) Web Sources:

1. <https://egyankosh.ac.in/bitstream/123456789/20753/1/Unit-1.pdf>
2. <https://www.pnw.edu/wp-content/uploads/2020/03/Lecture-Notes-5-7.pdf>
3. <http://www.gdcboysang.ac.in/About/droid/uploads/content/s%20of%20UNIT%20iV-part%20B.pdf>
4. <http://site.iugaza.edu.ps/aschokry/files/2014/09/SQC-CHAP-9-nw.pdf>
5. <https://youtu.be/Wp2nVlzBsE8>

Title of the Course: Practical for Programming in Python Semester: III
Course Code: LPSTCL31 Contact Hours: 4 Credits: 2

Course Learning Outcomes:

On completion of this course, the students will be able to

- describe python language syntax for simple program.
- examine the core data structure like conditional and loops.

- interpret the concepts of functions for mathematics.
- discover the capabilities to do sorting.
- identify the external modules for writing data operations to navigate the file systems.

List of Programs:

1. Perform Correlation and find the coefficient through syntax and data analysis option.
2. Perform regression analysis and find the equation of regression.
3. Perform t-test (paired sample) through syntax and data analysis option.
4. Perform t-test (equal variance) through syntax and data analysis option.
5. Find the slope of regression and draw the trend line from the given data.
6. Perform one-way ANOVA using the given data.
7. Chi-square test in Python.
8. Poisson distribution in Python.
9. Binomial distribution in Python.
10. Normal distribution in Python.
11. Non-parametric distribution in Python.
12. Correlation and Regression – Partial and Multiple Correlations, Multiple Regressions.

Title of the Course: Project and Viva-Voce/ Dissertation Semester: III
Course Code: LPSTPJ41 Contact Hours: 4 Credits: --

Course Learning Outcomes:

On completion of the course, the students are able to

- develop original thinking for formulating new problems and providing their solutions.
- understand should be sensitive to real experiences with respect to self, society and nation.
- analyze and interpret and take appropriate decisions in solving real life problems using statistical tools.

- use different Statistical package for graphical interface, data analysis and interpretations, write a systematic Statistical project report.
- be familiar with data collection, compilation, analysis and interpretation and writing of project reports independently.

Procedure:

1. Each student will be allotted a project Guide from the faculty of the Department concerned.
2. After the completion of the project work, the student has to submit four copies of project with report carrying his/her project report.
3. Project work will be evaluated by both external and the internal (Project Guide) examiners for the maximum of 100 marks in total on the scale of the maximum of 50 marks for the internal and the external each.
4. Viva-voce will be conducted by the panel comprising HOD, External examiner and Project Guide for the maximum of 100 marks in total on the scale of the maximum of 50 marks for the internal and the external each.

DEPARTMENT OF ENGLISH - PG-CBCS -LOCF

Title of the Course: English For Career Development (NME)	Semester: III
Course code: LPENNM31	Contact hours: 5hrs/w
	Credits: 4

Course Learning Outcomes:

On completion of the course, the students are able to

- have the comprehensive understanding of the language ability required in the competitive examination
- effectively use the vocabulary for the fluent and accurate communication
- exercise their grammatical competence in their communications
- confidently meet the job interview requirements

- practise the proficient language skills in all Professional and social interactions

Pre-required knowledge:

- Use of Basic Grammar for Job
- Communicative English for Career
- Writing Skills for Job Purposes

Unit I

Situational Grammar, Tenses, Voices, Prepositions, Articles

Unit II

Sentence Completion

One word Substitution

Homonyms

Phrasal Verbs

Unit III

Reading Comprehension

Analogy

Jumbled Sentence

Errors and How to avoid them

Unit IV

Job Application and Preparing a CV

Expansion of Idea

Report Writing

Essay Writing

Unit V

Interview

Group Discussion

Tips for taking Exam

Suggested Topics for presentation:

- Application process for various jobs
- Providing strategies for identifying the jobs
- Preparing resume for professional jobs

- Writing a clear and concise formal letter
- Developing interview skills

Suggested Readings:

i)Text Book:

Bhatnagar, R.P. *English for Competitive Examinations*, Madras: Laxmi Publication, 2009.

ii)Reference Books:

1. Sharma, Manish. *ITI Employability Skills*. Neelkand publishers, 2016.
2. Dixit, Shilpi. *Employability Skills*. BFC Publications, 2021.
3. Dhanavel, S.P. *English and Soft Skills*. Orient Blackswan, 2011.

iii)Web Source:

1. <https://www.coursera.org/learn/careerdevelopment>
2. <https://www.my.mooc.com/en/mooc/english-for-careerdevelopment>
3. <https://www.naukri.com/learning/english-for-careerdevelopmentcourse-couri202>

DEPARTMENT OF HISTORY – PG - CBCS – LOCF

Course Title : Indian History for Competitive Exams (NME)	Semester: III
Course code: LPHSNM31	Contact Hours: 5
Credits: 4	

Course Learning Outcomes:

On completion of this course, the students are able to

- understand the Indus Valley Civilisation.
- explain the administration of Mughals.
- analyse the causes and result of 1857 Mutiny.
- describe the salient features of Constitution of India.
- assess the current events in India and abroad.

Pre- required knowledge:

- Topics of competitive exams.
- Need of General Knowledge.
- Importance of Competitive exams.

Unit I : Ancient Indian History

Sources, - Indus Valley Civilization- Vedic Period - Mauryan Dynasty Buddhism and Jainism- Guptas.

Unit II: Medieval Indian History

Advent of Islam- Establishment of Delhi Sultanate – Mughals and Marathas- Advent of Europeans-Expansion and consolidation of British Rule- Social Reforms-Religious Movements.

Unit III: Indian National Movement

1857 Revolt - Indian National Congress – Gandhian Era – Role of Tamil Nadu in Freedom Struggle.

Unit IV: Indian Polity

Constitution of India-Preamble- Salient Features - Fundamental Rights and Duties - Panjayat Raj - Center and State Relation- Emergency Provisions- Election Commission- Amendments.

Unit V: Current Events

Profile of States - Defense - National Security and Terrorism, NGO - Eminent Persons and Places- Sports - Books and Authors-Cultural Panorama – Historical Events in India – Covid 19 .

Suggested topics for group discussion and presentation:

- Mauriyan Administration.
- Establishment of Delhi Sultanate.
- Indian National Movement.
- Emergency Provisions.
- Covid 19

Suggested Readings:

Text Books:

1. Ishwari Prasad, History of Medieval India, The Indian Press Ltd., Calcutta, 2006.
2. BipinCandra, History of Modern India, Orient Blackswan Publication, Hyderabad, 2009.

Reference Books:

1. NilakandaSastri, K. A. History of South India, Oxford Publication, Calcutta, 1982.

2. Basham, A.L. Wonder that was India, Rupa and Co Publisher, Delhi, 1967.
3. Bipan Chandra, Modern India, NCERT, New Delhi, 2005.
4. India and the contemporary World- I and II, NCERT, New Delhi.2000
5. Indian History, Part I,II, and III, NCERT, New Delhi,2007.

Web Sources:

- www.clearIAS.com
- www.jagranJosh.com
- www.UPSC.gov.in

DEPARTMENT OF ECONOMICS – PG – LOCF

Title of the Course: Economics for Competitive Examinations (NME)	Semester: III
Course Code: LPECNM31 Contact Hours: 5hrs/w	Credits: 4

Course Learning Outcomes

On completion of the course, the students are able to

- Grasp the measures of Economic development and role of NITI Aayog
- Acquire the Skill of analysing the Government policies on poverty and population growth.
- Evaluate India's trade policy and gain knowledge on IMF, IBRD and ADB.
- Analyse the working of Indian Money Market.
- Understand the issues in the Indian Federal system and competently appear for Competitive examinations.

Pre- required Knowledge

- Economic growth, Economic development and Economic Planning.
- Absolute Poverty Vs Relative Poverty.
- Internal trade Vs International trade.
- Indian Financial Market: Meaning and Structure.
- Direct tax, Indirect tax and Non-tax Revenue.

Unit I: Economic Development and Planning

National Income – Various Committees on National Income estimation – Measures of Economic Development(PQLI, HDI, HPI and GDI) – National Income as a measure of welfare – Green Revolution and agriculture development- History of Economic Planning in India – Planning Commission Vs NITI Aayog – India’s role in BRICS.

Unit II: Population and Poverty

Population growth in India – Demographic features of India - India’s Population Policy – Report of Lakdawala, Tendulkar and Rangarajan Committees on Poverty (Salient Points only) – Poverty Eradication Programme (IRDP, PMGAY, MGNREGA).

Unit III: International Trade Policy and Institutions

India’s Trade Policy – Special Economic Zones – Foreign Investment Policy – Foreign Exchange Rate Policy – FEMA – Globalisation and WTO – International Financial Institutions: IMF, IBRD and ADB.

Unit IV: Indian Money Market

Money Market: Features and instruments – Banking Sector Reforms – Primary Market Reforms – Inflation and controlling measures in India

Unit V: Federal Financial System in India

Federal Structure – Consolidated and Contingency Funds of India – Public Account – Centre – State Financial Relation – Finance Commission – GST and GST Council - Fiscal Sector reforms in India – State Finances – Fiscal Responsibility and Budget Management (FRBM) Act - Local Finances.

Suggested topics for group discussion/ Presentation

- NITI Aayog differs from Planning Commission in terms of composition and powers.
- Poverty estimation suffers from various methodological issues.
- International Monetary Fund (IMF) provides international liquidity.
- Indian Banking Sector reform measures are based on Basel- III norms.

- State governments are suspicious of the motives of the government of India in raising and sharing of tax revenues with them.

Suggested Readings

Text Books

1. Ramesh Singh(2019), Indian Economy for Civil services, Universities and other Examinations, McGraw Hill Education, New Delhi.
2. Misra and Puri, (2019), Sectoral Problems Of Indian, Economy, Himalayas Publishing House.
3. Rudder Datt and Sundaram, (2018), Indian Economy, S. Chand, New Delhi.

Reference Books

1. Francis Cherunilam, (2019) International Trade and Export Management, Himalaya Publishing House.
2. Uma kapila (Ed.) (2018), Indian Economy since independence, Academic Foundation, New Delhi, 29 th edition.
3. Gupta. K. R and Manoranjansharma (2018), Indian Economic Policies and Data McGraw Hill Publications.
4. Abhijit, V. Banerjee et al. (2017), poverty and income distribution I India, juggernaut, New Delhi.
5. Prakash B.A (2009) , The Indian Economy since 1991, Edited Book, Pearson Education New Delhi.
6. Iswar C. Dinkara, (2009) , The Indian Economy: Environment and Policy, Sultan Chand and Co.
7. Manmohan Agarwal and Amit shovon Toy, (2007) ,Globalisation and the Millinnium Development Goals, Orient Black Swan, Hyderabad.
8. Brahmananda, P. R, and V. R. Panchmuki (Eds) (2001), Development Experience in the Indian Economy: Inter-state Respective, Bookwell, Delhi.
9. Ahluwalia, I. J and I. M. D. Little (Eds) , (1999), India's Economic Reforms and Development, oxford Universities Press, New Delhi.

10. Agarwal, A.N, (1981), Indian Economy, Vishwa prakashan, New Delhi.

Web Sources

<https://www.vedantu.com/commerce/national-income>

https://en.m.wikipedia.org/wiki/Demographics_of_India

<https://en.m.wikipedia.org/wiki/Federation>

DEPARTMENT OF COMMERCE - PG - CBCS - LOCF

Title of the Paper: Entrepreneurship Development (NME)	Semester: III
Course Code: LPCONM31	Contact Hours: 5hrs/w
	Credit: 4

Course Learning Outcome:

- On completion of the course, the students are able to
- know the factors affecting entrepreneurial growth.
 - identify the problems faced by women entrepreneurs.
 - identify the various institutional support to the entrepreneur.
 - advocate for subsidy and incentives to be received from the Government.
 - prepare the project reports.

Pre-required knowledge:

- ✓ Entrepreneurial venture
- ✓ Scope for women entrepreneurship
- ✓ Financial assistance from government

Unit- I: Introduction to Entrepreneurs

Entrepreneur - Definition - Concept - Characteristics - Qualities - Classification of entrepreneurs - Entrepreneur Vs Manager - Role of Entrepreneurs in the economic development -- Factors affecting entrepreneurial growth.

Entrepreneurship- Concept - Distinction between Entrepreneur and Entrepreneurship

Unit- II: Women Entrepreneurs

Introduction - Definition - Problems - Suggestions to overcome - Government steps towards Women Entrepreneurs - Institutions support to women Entrepreneurs in India.

Entrepreneurship Development Programmes (EDP):

Meaning - Objectives - Stages in EDP- Pre-training Stage - Training phase - Post Training - Evaluation and Feedback of EDP.

Unit- III : Assistance to Entrepreneurs:

Financial and Non-Financial Institutions - TIIC and SFC - DIC - SIDBI - SIDCO - Commercial Banks.

Unit- VI : Incentives and Subsidies:

Incentives and subsidies of State and Central Govt - Objectives -Aims - Tax Concession - Assistance to MSME's - Backward areas - Industrial Estates

Unit-V : Project Report:

Meaning - Steps - Contents - Reasons for failure of a Project Report – Format – Guidelines.

Suggested Topics/Practical Exercises:

The learners are required to

- ✓ list the various factors affecting entrepreneurial growth.
- ✓ explain the steps to overcome the problem face by women entrepreneur.
- ✓ name any two financial institutions supporting entrepreneurs to grow in Tamilnadu.
- ✓ cite examples for the growth of business using Seed Capital Assistance / Scheme.
- ✓ draw a project report for a new business concern.

Suggested Readings:

(i) Text Books

1. Gupta.C.B. (2018). Entrepreneurship Development. New Delhi: Sultan Chand and Sons.
2. Gordon. E. and Dr. Natarajan. K. (2020). Entrepreneurship Development. Mumbai: Himalaya Publishing House.

(ii) Reference Books

1. Gupta . C.B.& Srinivasan. N.P. (2018), Entrepreneurship Development. New Delhi: Sultan Chand and Sons.

2. Khanka S.S. (2018) Entrepreneurial Development. New Delhi: S.Chand & Company Ltd..
3. Kanishka Bedi. (2012). Management and Entrepreneurship, New Delhi: Oxford University Press.

(iii) Web-Sources:

1. www.tiic.in
2. www.sidco.in
3. www.dic.in

DEPARTMENT OF MATHEMATICS – PG – CBCS - LOCF

Title of the Course: Mathematics for Competitive Examinations (NME)	Semester: III
Course Code: LPMSNM31	Contact Hours : 5hrs/w
	Credits: 4

Course Learning Outcomes:

- On completion of the course, the students are able to
- formulate the problem quantitatively
 - recall appropriate arithmetical methods to solve the problem
 - demonstrate various principles involved in solving mathematical problems.
 - evaluate various real life situations by resorting to analysis of key issues and factors
 - develop various mathematical skills to solve the problems

Pre-required Knowledge:

- ✓ Addition and subtraction
- ✓ multiplication and division
- ✓ product tables

Unit I:Quantitative Aptitude - I

HCF and LCM of numbers-Decimal Fractions – Simplification - Average-Problems on numbers-Problems on ages.

Unit II: Quantitative Aptitude – II

Percentage-Profit and loss-Ratio and proportion- Partnership-Simple interest-Compound interest.

Unit III: Quantitative Aptitude - III

Time and work-Time and distance-Problems on trains- Alligator or mixture.

Unit IV: Quantitative Aptitude and logic

Calendar – Clocks – Stock and shares - Odd man out and series.

Unit V: Reasoning

Verbal and non-verbal reasoning- verbal Reasoning – Analogy - Mathematical operations – Inserting the character. Non-Verbal Reasoning – Analytical Reasoning

Suggested Topics for Group Discussion/ Presentations:

1. Simplification
2. Simple and compound interest
3. Problems on trains
4. Stock and shares
5. Non-verbal reasoning

Suggested Readings:

(i) Text Books:

1. R.S. Agarwal, Quantitative Aptitude for Competitive Examinations Revised and Enlarged edition, S.Chand Publications, New Delhi, Reprint 2007.
2. R.S. Agarwal, Verbal and Non-Verbal reasoning S.Chand Publications, New Delhi, Reprint 2009.

Unit I: Book1: Section 2,3,4,6,7& 8.

Unit II: Section 10,11,12,13,21 & 22.

Unit III: Section 15,17,18& 20.

Unit IV: Section 27,28,29 & 35.

Unit V: Book 2: Part I – Section I- 2,13 &16. Part II – Section – 4

(ii) Reference books:

1. R.Gupta, Quantitative Aptitude, Unique Publishers Pvt. Ltd, 2013.
2. Arora. P.N. and Arora. S., Quantitative Aptitude Mathematics, Volume-1 S Chand & Company Ltd., New Delhi, 2009.
3. Kothari. C.R., Quantitative Techniques, Vikas Publishing House Pvt. Ltd., New Delhi, 1989.
4. Srinivasan. T.M., Perumalswamy. S. and Gopala Krishnan. M.D., Elements of Quantitative Techniques, Emerald Publishers, Chennai, 1985.

(iii) Web Resources:

1. <https://mathematician0.weebly.com/>
2. <https://youtu.be/rHzggZDd4>
3. <https://youtu.be/ZADjT-wsQJw>
4. <https://youtu.be/ETiRE7N7pEI>
5. <https://www.youtube.com/watch?v=tn9ojlTRg4&list=PLpyc33gOcbVA4qXMoQ5vmhefTruk5t9lt>

DEPARTMENT OF CHEMISTRY – PG – CBCS-LOCF

Title of the paper: CHEMISTRY FOR ALL (NME)	Semester: III
Course Code:LPCHNM31	Contact Hours: 5hrs/w
	Credits: 4

Course Learning Outcomes:

On completion of the course, the students are able to

- ✓ know the basic chemistry involving types of elements and chemical reactions.
- ✓ study different concepts of acids and bases and various chemical processes
- ✓ gain awareness on Pollution and types of pollution
- ✓ know the details of plastics, glass, cement, types of fuels
- ✓ gain knowledge in vitamins, food adulterants and Classification and biological functions of antibiotics

Pre-Required Knowledge

- ✓ Properties of Metals and non-metals
- ✓ Isotopes, Isobar and isotones
- ✓ Stability of Colloidal solution
- ✓ Thermosetting and thermoplastics
- ✓ Green house effect and global warning

Unit I: BASIC CHEMISTRY- I

Elements – atoms and molecules – Metals and non metal – metalloids, alloy, ore and minerals - Chemical formulae and symbols – Important basic terms such as pressure, volume, atomic mass, molecular mass, temperature, atomic number – Types of chemical reactions (exothermic and endothermic, Physical and chemical changes, oxidation and reduction) – ideal and real gas - Important laws of Chemistry (Boyle's law, Charles's law, Hess's law, Graham's law of diffusion, Beer's law, Henry's law, Faraday's law, Law of conservation of matter or energy).

Unit II: BASIC CHEMISTRY- II: (Only elementary idea can be given)

Different concepts of Acids and Bases (Arrhenius, Bronsted and Lewis) – pH concept (no calculation) – Water – Hard and soft water - Chemical nature of metals- Steel and iron (no manufacture) – heat treatment of steel – Solutions and their types (True, Colloidal and suspension) – uses of colloidal solution – Buffer solution – Nuclear Chemistry – isotopes and radioactivity Definitions of some important chemical processes (Haber's, Contact's, Ostwald's, Processes)

Unit III: ENVIRONMENTAL CHEMISTRY

Pollution and types of pollution – Composition of atmosphere – Major regions of atmosphere and their characteristics – Elementary idea of Green house effects and Acid rain – Air pollution – Control of air pollution and their harmful effects – CFC, Global warming, substitute for CFC (Just name only)-Water pollution – Dissolved oxygen – BOD, COD and TDS (elementary idea only)

Unit IV: CHEMISTRY IN SERVICE OF MAN –I: (Only elementary idea can be given)

Plastics – Classification with examples – Polymer (natural and synthetic) – Soaps and Glass – Annealing of glass – Cement – Constituents and setting and hardening of cement – Rubber – Types with examples and vulcanization of rubber- Corrosion of metal – prevention – Lubricants (definition and classification) – Fuel – Classification with suitable examples - calorific value – LPG and Rocket fuel.

Unit V: Chemistry in service of man –II: (Only elementary idea can be given)

Food adulterants – common food adulterants and their harmful effects and tests to identify them– Classification and biological functions of Vitamins A, B6, B12, C, D, E and K (structural elucidation not required) – Classification and biological functions of antibiotics – penicillin, chloroamphenicol, streptomycin and tetracycline.

Suggested Topics For Group Discussion/ Presentations

- ✓ Metals and nonmetal
- ✓ Steel and iron
- ✓ Green house effects
- ✓ vulcanization of rubber
- ✓ organic and Inorganic pesticides

Suggested Readings

Text Books:

1. A Text book of Environmental Chemistry, O.D.Tyagi, M. Mehra, Anmol Publication, 1990.
2. Puri, Sharma and Pathania, Principles of Physical Chemistry, Vishal Publishing Co., 2004
3. Puri, Sharma and Pathania, Principles of Inorganic Chemistry, Vishal Publishing Co., 2004

Reference Books:

1. Applied Chemistry, K. BagawathiSundari, MJP Publishers, Chennai – 2006.
2. General Studies Manual, The TMH Publishers, 2008
3. Basic concepts of chemistry (HB) by Pegasus sold by Amazon Asia-Pacific Holdings Private Limited, 2018.

Websites and e-Learning Sources:

1. <https://youtu.be/eJXL0lrbtqE>
2. <https://2012books.lardbucket.org/pdfs/beginning-chemistry.pdf>
3. <https://youtu.be/J0v3stz7izA>
4. <https://youtu.be/EyBkPwsRY2E>
5. https://youtu.be/yU3GwJu_yNA
6. <https://youtu.be/uMBeXHnWhsE>
7. https://youtu.be/lUg7r7fu_eo
8. <https://youtu.be/eJXL0lrbtqE>

DEPARTMENT OF BOTANY - PG - CBCS - LOCF

Title of the Course: Plants and Human Welfare (NME)	Semester: III
Course Code: LPBYNM31	Contact hours: 5hrs/w
	Credit: 4

Course Learning Outcomes:

On completion of the course, the students are able to

- acquire knowledge on Plants as food
- understand the cultivation of mushrooms.
- recognize the need of plant drugs.
- familiarize with the wood and its types.
- come to know about the Organic farming.

Pre-required knowledge:

- Plant groups
- Raw drugs
- Farming techniques

Unit I: Plants as food

Importance of plant genetic resources and utilization. Present status of resources in India. Agricultural, vegetable, horticultural and medicinal plants. Higher plants as food - Cereals- Rice, Pulses- Pigeon pea.

Unit II: Cultivation of mushrooms – *Pleurotus*

General characters of mushroom – present status of the mushroom industry in India common edible and non-edible mushrooms. Nutritive and Energy value of edible mushrooms.

Unit III: Biological Drugs

Brief history and scope of raw drugs of plant origins. Definition, herbals, classification and description. Classification of vegetable drugs. Biological sources of drugs.

Unit IV: Timbers

Structure of wood, sap wood – heart wood transition, properties of wood (Physical, chemical & mechanical). Dendrochronology and its significance. Commercial uses of woods of South India - Teak (*Tectona grandis*), Neem (*Azadirachta indica*).

Unit V: Organic farming

Organic farming, vermin-composting. Leguminous plants in green manuring. Biofertilizer -*Rhizobium* and Blue green algae (*Nostoc*); Biopesticides: *Bacillus thuringiensis*.

Suggested Topics for Seminar/Presentation/Group Discussion:

- Plants as food
- Recent methods for mushroom cultivation
- Biological sources of drugs
- Dendrochronology and its significance
- Techniques of vermicomposting and Methods of organic farming

Suggested Readings:

Text Books:

1. Albert F. Hill. (1952). Economic Botany. Tata McGraw-Hill Publishing Company Ltd., New Delhi.
2. Pradeep Sachdeva. (2014). A Naturalists Guide to the Trees & Shrubs of India. *Prakash books* Publishers, Chennai. ISBN: 978817599408.

3. Board Eiri (2008) Hand Book of Tree Farming. *Engineers India Research Institute Publishers*. New Delhi.
4. Suman, B.C. & Sharma, V.P. (2007). Mushroom cultivation in India. *DayaPublishingHouse*, Delhi.

Reference Books

1. Dorian Q. Fuller, Eleni Asouti.(2008)Trees and Woodlands of South India. *Munshiram Manoharlal Publishers*. New Delhi. ISBN: 9788121512145.
2. Sanjay Tiwari, and Nikhil Devasar. (2019). 100 Indian Trees: The Big Little Nature Book. *DK India publishers*, New Delhi.
3. NeginhaS.G. (2020). Forest Trees of South India. *Notion Press publishers*, Chennai.
4. Diego Cunha Zied, Arturo Pardo-GimAcnez. (2017). Edible and Medicinal Mushrooms: Technology and Applications. *John Wiley & Sons*.
5. Kochhar, S.L. (1981). Economic Botany in the Tropics. *McMillan India Ltd.*, Madras.
6. Mukharjee, S.K. (1969). Survey of Plants of India. *Bull. Botanical Survey India*, 11(3): 217-223.
7. Sambamurthy, A.V.S.S. and N.S. Subramaniam. (1989). A Textbook of Economic Botany. *Wily Eastern Ltd.*, New Delhi.
8. Albert E Hill and O P Sharma (1996). Economic Botany. *Tata McGraw Hill Co. Ltd.*, New Delhi.
9. Anonymous. (1948-1976). The Wealth of India - A Dictionary of Indian Raw Materials and Industrial Products. Vol. I to X. *Publication and Information Directorate, CSIR*, New Delhi.

Web Sources:

1. <https://byjus.com/biology/food-sources-animal-plant-products/>
2. <https://foodplantsinternational.com/>
3. https://namyco.org/mushroom_cultivation_resources.php

4. <https://www.fs.fed.us/wildflowers/ethnobotany/medicinal/index.shtml>

DEPARTMENT OF PHYSICS – PG – CBCS - LOCF

Title of the Course: Physics for Competitive Examinations (NME) **Semester: III**

Course Code: LPPHNM31 **Contact Hours: 5hrs/w** **Credit: 4**

Course Learning Outcomes:

On completion of the course, the students are able to

- understand various systems of units and newton's laws of motion
- acquire the basic knowledge on gravitation
- understand the various aspects in electrostatics and electricity
- have knowledge on various properties of light
- understand the electronic devices, circuits and various number systems

Pre-Required Knowledge:

- ✓ Gravitational force, acceleration due to gravity mass and other physical quantities
- ✓ Heat, energy, temperature, basic mathematics, basic ideas on charge and current
- ✓ Elementary idea on planetary systems and space

Unit I: Systems of Units and Newton's Laws

System of units S.I.- Fundamental units- derived units – Dimension of physical quantity – uses of dimensional equations – limitation of dimensional analysis. Force and inertia, Newton's first law of motion – momentum – second law of motion – conservation of linear momentum – Newton's Third law of motion – friction – laws of limiting friction – static and dynamic friction.

Unit II: Gravitation

Gravitation-Kepler's law of planetary motion – universal law of gravitation – acceleration due to gravity – variation of 'g' at poles – equator – Altitude – depth – rotation of earth –

difference between mass and weight – Inertial mass and gravitational mass – Satellite – Orbital velocity – escape velocity – Rocket.

Unit III: Electrostatics and Electricity

Charge and fields – Coulomb's law – electric field due to a point charge – Gauss law – Application of Gauss law – Electric field due to parallel sheet of charge – Electric potential – Potential due to a point charge – Capacitor – Principle of a capacitor – Capacitance of a parallel plate capacitor – Effect of dielectric on capacitance – current and resistance – Electric current – Current density – Expression for current density – Ohm's law and electrical conductivity – Kirchoff's law – Application of Kirchoff's law to Wheatstone network and measurement of resistance.

Unit IV: Optics and Sound

Light – Reflection of light – Laws of reflection – Refraction of light – Laws of reflection – Dispersion visible range dual nature – Total internal reflection – Laser – Interaction of light with matter – Population inversion - Applications of laser. Simple Harmonic motion – Progressive wave properties – stationary waves – properties – ultrasonic – Properties and applications.

Unit V: Electronics

Difference between conductor, insulator and semiconductor using band theory – Intrinsic and extrinsic semiconductor – semiconductor diode – diode as a rectifier – Photo diode – LED – Zener diode as a voltage regulator – Number system – Binary, octal, Hexadecimal – Inter conversion – Cray code – exes 3 code , ASCII code – Basic gates – De-Morgan's theorem – Universal gates – Binary addition – Binary subtraction – 2's complement method - 1's complement method – binary multiplication – binary division.

Suggested Topics for Group Discussion/Presentation:

- ✓ Newton's laws of motion, concept of friction and its associated quantities
- ✓ Newton's law of Gravitation-Kepler's law of planetary motion,

- ✓ Electrostatics force, Electric field, electric potential, capacitors. Ohm's law Kirchoff's law
- ✓ Various properties of light, laser fundamentals and applications, Ultrasonics and applications.
- ✓ Various types of semiconductor devices, binary number systems

Suggested Readings:

(i) Text Books:

1. Murugesan, R. Mechanics, Properties of matter and sound. For Bsc ancillary physics, Reprint (2016).
2. Murugesan, R. Optics, Spectroscopy and Modern Physics, For Bsc ancillary physics, 1st edition (2017).
3. Murugesan, R. Electricity and electronics, for B.Sc Ancillary Physics, 1st edition, (2014).

(ii) Reference Book:

Halliday, D. Resnick, R and Walker, J. Principle of Physics, International Student version, Wiley India Private Ltd., 9th edition, reprint (2012).

(iii) Web Sources:

1. <https://www.khanacademy.org/science/physics>
2. https://ocw.uci.edu/courses/physics_3a_basic_physics.html
3. <https://www.concepts-of-physics.com/dr-hc-verma/videos.php#hc-verma-videos-on-mechanics>

Title of the Course: Statistics for SET/NET Examinations Semester: III

Course Code: LPSTAE31

Contact Hours: 2

Credits: 2

Course Learning Outcomes:

On completion of the course, the students are able to

- gain knowledge of mathematical analyses of the reasoning in to real life problems.
- familiarize the distributions of random variables frequently used in statistics.

- solve real life problems by applying suitable non-parametric testing procedure.
- acquire the knowledge of simple linear regression analysis.
- develop the statistical software in relation to different techniques for factorial experiments.

Pre Required Knowledge:

- ✓ Basic knowledge of mathematical operations.
- ✓ Fundamental of estimation and hypotheses.
- ✓ Basic concepts of regression line and design of models.

Unit I: General Aptitude

Mathematical problems – Puzzle test – Series completion test – Direction sense test – Blood-relation test – Practice test – Data interpretation – Elastic and inelastic collisions – Newton’s law of gravitation – Moment of inertia – Motion of a body suspended by a spring – Effects on velocity of sound – Mechanical equivalent of heat – Capacitance and capacitor – Wave length range – Magnification-electron energy levels in hydrogen – Activity of radioactive substance.

Unit II: Point Estimation

Random sampling and data description – Point estimation of parameters – Point estimate – Unbiased estimator – Minimum variance unbiased estimator – Standard error – Methods of point estimation – Population moment – Maximum likelihood estimator – Sampling distribution of two samples – Statistical intervals for a single sample - Confidence interval – One-sided confidence bounds – Large-sample confidence interval.

Unit III: Testing of Hypotheses

Tests of hypotheses for a single sample – Hypothesis testing – One-sided and Two- sided hypothesis – Hypothesis tests on the mean – Hypothesis tests of variance – Testing for goodness of fit – Statistical inference for two samples – Hypothesis tests for a difference in means, variances – Confidence interval on the difference in means, variances – Hypotheses testson the ratio of two variances – Inference on two population proportions.

Unit IV: Linear Regression Model and Non-Parametric Statistics

Simple linear regression – Least squares estimates – Analysis of variance approach to test significance of regression – Confidence intervals on the slope and intercept – Multiple linear regressions. – Sign test – Wilcoxon signed-Rank test – Kruskal-Wallis test – Wald-Wolfowitz run test.

Unit V: Design of Experimental

Completely randomized single-factor experiment – Analysis of variance for a single-factor experiment, Fixed-effects model – Randomized complete block design – ANOVA for a randomized complete block design – Two-factor factorial experiments – General factorial experiments.

Suggested Topics for Group Discussion/ Presentation

- ✓ Blood-relation test.
- ✓ Maximum likelihood estimator.
- ✓ One-sided and Two-sided hypothesis.
- ✓ Sign test.
- ✓ Randomized complete block design.

Suggested Readings:

i) Text Book:

1. Alok Kumar, Mathematical Sciences, Latest Revised Edition, Publishers UpkarPrakashan, AGRA, 2019.

ii) Reference Books:

1. B. L. Agarwal, Basic Statistics, New age International (P) Ltd., New Delhi, 1996.
2. E. L. Lehmann, Testing Statistical Hypotheses, Wiley Eastern, New Delhi, 1976.
3. S. Arora, B. Lal, New Mathematical Statistics, Satya Prakashan, New Delhi, 1989.

iii) Web Sources:

1. <https://testbook.com/learn/maths-data-interpretation/>
2. <https://stt.msu.edu/Academics/ClassPages/uploads/US19/351-101/Lecture-10.pdf>

3. [https://people.stat.sc.edu/sshen/courses/17smstat509/notes/Chapter%207%20Statistical%20Inference%20\(Two%20Samples\).pdf](https://people.stat.sc.edu/sshen/courses/17smstat509/notes/Chapter%207%20Statistical%20Inference%20(Two%20Samples).pdf)
4. <https://www.youtube.com/watch?v=sJvRbLel4oM>
5. <https://math.montana.edu/jobost541/sec4a.pdf>

Title of the Course: Statistical Data Analysis with R **Semester: III**
Course Code: LPSTSC31 **Contact Hours: Self-study** **Credits: 2**

Course Learning Outcomes:

On completion of the course, the students are able to

- understand the data structures in R.
- apply the statistical techniques in R.
- gain knowledge in data types.
- analyze of the import new function packages into the R.
- perform appropriate statistical tests using R and create and edit visualizations with R.

Unit I: Statistical Software R and Descriptive Statistics

R and its development history – Structure of R – Installation of R – Working with R –Basics – Excursus: Data Import and Export with R – Import of ICU-Dataset.

Unit II: Colors and Diagrams

Categorical Variables – Metric Variable – Colors – Excursus: Export of Diagrams – Diagrams.

Unit III: Probability Distributions

Discrete Distributions – Continuous Distributions.

Unit IV: Estimation

Introduction – Point Estimation – Confidence Intervals.

Unit V: Statistical Tests

Introduction – Examples.

Suggested Readings:

i) Text Book:

1. Matthias Kohl, Introduction to Statistical Data Analysis with R, First Edition, Villingen-Schwenningen, 2015.

Unit I	:	Chapter 1	Chapter 2
	:	Sections 1.1 to 1.4	
	:	Sections 2.1 to 2.3	
Unit II	:	Chapter 2	Chapter 3
	:	Sections 2.4, 2.5	
	:	Sections 3.1 to 3.3	
Unit III	:	Chapter 4	: Sections 4.1, 4.2
Unit IV	:	Chapter 5	: Sections 5.1 to 5.3
Unit V	:	Chapter 6	: Sections 6.1, 6.2

ii) Reference Books:

1. J. D. Long and Paul Teetor, R cookbook Proven Recipes for data analysis, statistics, and graphics, Published by O'Reilly Media, 2019.
2. S. G. Purohit, S. D. Gore, and S. R. Deshmukh, Statistics Using R, Narosa Publishing House, New Delhi, 2009.
3. J. M. Quick, Statistical Analysis with R, Pack Publishing Ltd., UK, 2010.

iii) Web Sources:

1. <http://www.utstat.utoronto.ca/~radford/sta2102.S03/R-manual/R-data.html>
2. <https://www.youtube.com/watch?v=y3YL5dUJNvc>
3. <https://www.stat.umn.edu/geyer/old/5101/rlook.html>
4. https://www.math.kth.se/matstat/gru/Statistical%20inference/Lecture4_2015.pdf
5. https://users.php.ufl.edu/rlp176/Courses/PHC6089/R_notes/StatisticalAnalysis.htm I

Title of the Course: Fundamentals of Data Science **Semester: III**
Course Code: LPSTSC32 **Contact Hours: Self-study** **Credits: 2**

Course Learning Outcomes:

On completion of the course, the students are able to

- understand the data developer to data scientist.
- demonstrate the data analytics techniques using R.
- explain the applications of database models.
- analyze of the data mining.
- examine the usage of various database regression.

Unit I: Transitioning from Data Developer to Data Scientist

Data developer thinking – Objectives of data developer
 – Developer versus scientist –Advantages of thinking like a data scientist – Transitioning to a data scientist.

Unit II: Declaring the Objectives

Key objectives of data science – Exploring and visualizing data – Statistical population– Categorical data – Decision trees – Big data.

Unit III: A Developer’s Approach to Data Cleaning

Understanding basic data cleaning – R and common data issues – Transformations – Deductive correction – Deterministic imputation.

Unit IV: Data Mining and the Database Developer

Data mining – Mining versus querying – Dimensional reduction – Frequent patterning– Sequence mining.

Unit V: Statistical Analysis for the Database Developer

Data analysis – Statistical analysis – Summarization – Establishing the nature of data – Successful statistical analysis – R and statistical analysis – Introducing statistical regression – Identifying opportunities for statistical regression.

Suggested Readings:

i) Text Book:

1. James D. Miller, Statistics for Data Science, First Edition, Published by Pack PublishingLtd., UK, 2017.
 - Unit I : Chapter 1
 - Unit II : Chapter 2
 - Unit III : Chapter 3
 - Unit IV : Chapter 4
 - Unit V : Chapters 5 and 6

ii) Reference Books:

1. Kotu, Deshpande, Data Science: Concepts and Practice, Elsevier Science Publisher, 2018.
2. Zumel, Nina, and Mount, John, Practical Data Science with R, Manning Publications, 2019.
3. Shan, Chirag, A Hands-on Introduction to Data Science, Cambridge University Press, 2020.

iii) Web Sources:

1. <https://www.analyticsvidhya.com/blog/2020/11/how-to-transition-data-science-different-backgrounds/>
2. <https://www.sciencedirect.com/topics/computer-science/categorical-data>
3. <https://www.tableau.com/learn/articles/what-is-data-cleaning>
4. https://www.vssut.ac.in/lecture_notes/lecture1428550844.pdf
5. https://www.pacc.in/e-learning-portal/ec/admin/contents/22_MCM34_2020112906462433.pdf

DEPARTMENT OF ENGLISH - PG-CBCS -LOCF

Title of the Course: English For Career Development (NME) Semester: III

Course code: LPENNM31

Contact hours: 5hrs/w

Credits: 4

Course Learning Outcomes:

On completion of the course, the students are able to

- have the comprehensive understanding of the language ability required in the competitive examination
- effectively use the vocabulary for the fluent and accurate communication
- exercise their grammatical competence in their communications
- confidently meet the job interview requirements
- practise the proficient language skills in all Professional and social interactions

Pre-required knowledge:

- Use of Basic Grammar for Job
- Communicative English for Career
- Writing Skills for Job Purposes

Unit I

Situational Grammar, Tenses, Voices, Prepositions, Articles

Unit II

Sentence Completion

One word Substitution

Homonyms

Phrasal Verbs

Unit III

Reading Comprehension

Analogy

Jumbled Sentence

Errors and How to avoid them

Unit IV

Job Application and Preparing a CV

Expansion of Idea

Report Writing

Essay Writing

Unit V

Interview

Group Discussion

Tips for taking Exam

Suggested Topics for presentation:

- Application process for various jobs
- Providing strategies for identifying the jobs
- Preparing resume for professional jobs
- Writing a clear and concise formal letter
- Developing interview skills

Suggested Readings:

i)Text Book:

Bhatnagar, R. P. *English for Competitive Examinations*, Madras: Laxmi Publication, 2009.

ii) Reference Books:

1. Sharma, Manish. *ITI Employability Skills*. Neelkand publishers, 2016.
2. Dixit, Shilpi. *Employability Skills*. BFC Publications, 2021.
3. Dhanavel, S.P. *English and Soft Skills*. Orient Blackswan, 2011.

iii)Web Source:

1. <https://www.coursera.org/learn/careerdevelopment>
2. <https://www.my.mooc.com/en/mooc/english-for-careerdevelopment>
3. <https://www.naukri.com/learning/english-for-careerdevelopmentcourse-couri202>

DEPARTMENT OF HISTORY – PG - CBCS – LOCF

Course Title : Indian History for Competitive Exams (NME)	Semester: III
Course code: LPHSNM31	Contact Hours: 5
	Credits: 4

Course Learning Outcomes:

On completion of this course, the students are able to

- understand the Indus Valley Civilisation.
- explain the administration of Mughals.
- analyse the causes and result of 1857 Mutiny.
- describe the salient features of Constitution of India.
- asses the current events in India and abroad.

Pre- required knowledge:

- Topics of competitive exams.
- Need of General Knowledge.
- Importance of Competitive exams.

Unit I : Ancient Indian History

Sources, - Indus Valley Civilization- Vedic Period - Mauryan Dynasty Buddhism and Jainism- Guptas.

Unit II: Medieval Indian History

Advent of Islam- Establishment of Delhi Sultanate – Mughals and Marathas- Advent of Europeans-Expansion and consolidation of British Rule- Social Reforms-Religious Movements.

Unit III: Indian National Movement

1857 Revolt - Indian National Congress – Gandhian Era – Role of Tamil Nadu in Freedom Struggle.

Unit IV: Indian Polity

Constitution of India-Preamble- Salient Features - Fundamental Rights and Duties - Panjayat Raj - Center and State Relation- Emergency Provisions- Election Commission- Amendments.

Unit V: Current Events

Profile of States - Defense - National Security and Terrorism, NGO - Eminent Persons and Places- Sports - Books and Authors-Cultural Panorama – Historical Events in India – Covid 19 .

Suggested topics for group discussion and presentation:

- Mauriyan Administration.
- Establishment of Delhi Sultanate.
- Indian National Movement.
- Emergency Provisions.
- Covid 19

Suggested Readings:

Text Books:

1. Ishwari Prasad, History of Medieval India, The Indian Press Ltd., Calcutta, 2006.
2. BipinCandra, History of Modern India, Orient Blackswan Publication, Hyderabad, 2009.

Reference Books:

1. NilakandaSastri, K. A. History of South India, Oxford Publication, Calcutta, 1982.
2. Basham, A.L. Wonder that was India, Rupa and Co Publisher, Delhi, 1967.
3. Bipan Chandra, Modern India, NCERT, New Delhi, 2005.
4. India and the contemporary World- I and II, NCERT, New Delhi.2000
5. Indian History, Part I,II, and III, NCERT, New Delhi,2007.

Web Sources:

- www.clearIAS.com
- www.jagranJosh.com
- www.UPSC.gov.in

DEPARTMENT OF ECONOMICS – PG – LOCF

Title of the Course: Economics for Competitive Examinations (NME) Semester: III

Course Code: LPECNM31 Contact Hours: 5hrs/w Credits: 4

Course Learning Outcomes

On completion of the course, the students are able to

- Grasp the measures of Economic development and role of NITI Aayog
- Acquire the Skill of analysing the Government policies on poverty and population growth.
- Evaluate India's trade policy and gain knowledge on IMF, IBRD and ADB.
- Analyse the working of Indian Money Market.
- Understand the issues in the Indian Federal system and competently appear for Competitive examinations.

Pre- required Knowledge

- Economic growth, Economic development and Economic Planning.
- Absolute Poverty Vs Relative Poverty.
- Internal trade Vs International trade.
- Indian Financial Market:Meaning and Structure.

- Direct tax, Indirect tax and Non-tax Revenue.

Unit I: Economic Development and Planning

National Income – Various Committees on National Income estimation – Measures of Economic Development(PQLI, HDI, HPI and GDI) – National Income as a measure of welfare – Green Revolution and agriculture development- History of Economic Planning in India – Planning Commission Vs NITI Aayog – India’s role in BRICS.

Unit II: Population and Poverty

Population growth in India – Demographic features of India - India's Population Policy – Report of Lakdawala, Tendulkar and Rangarajan Committees on Poverty (Salient Points only) – Poverty Eradication Programme (IRDP, PMGAY, MGNREGA).

Unit III: International Trade Policy and Institutions

India's Trade Policy – Special Economic Zones – Foreign Investment Policy – Foreign Exchange Rate Policy – FEMA – Globalisation and WTO – International Financial Institutions: IMF, IBRD and ADB.

Unit IV: Indian Money Market

Money Market: Features and instruments – Banking Sector Reforms – Primary Market Reforms – Inflation and controlling measures in India

Unit V: Federal Financial System in India

Federal Structure – Consolidated and Contingency Funds of India – Public Account – Centre – State Financial Relation – Finance Commission – GST and GST Council - Fiscal Sector reforms in India – State Finances – Fiscal Responsibility and Budget Management (FRBM) Act - Local Finances.

Suggested topics for group discussion/ Presentation

- NITI Aayog differs from Planning Commission in terms of composition and powers.
- Poverty estimation suffers from various methodological issues.
- International Monetary Fund (IMF) provides international liquidity.
- Indian Banking Sector reform measures are based on Basel- III norms.

- State governments are suspicious of the motives of the government of India in raising and sharing of tax revenues with them.

Suggested Readings

Text Books

1. Ramesh Singh(2019), Indian Economy for Civil services, Universities and other Examinations, McGraw Hill Education, New Delhi.
2. Misra and Puri, (2019), Sectoral Problems Of Indian, Economy, Himalayas Publishing House.
3. Rudder Datt and Sundaram, (2018), Indian Economy, S. Chand, New Delhi.

Reference Books

1. Francis Cherunilam, (2019) International Trade and Export Management, Himalaya Publishing House.
2. Uma kapila (Ed.) (2018), Indian Economy since independence, Academic Foundation, New Delhi, 29 th edition.
3. Gupta. K. R and Manoranjansharma (2018) , Indian Economic Policies and Data McGraw Hill Publications.
4. Abhijit, V. Banerjee et al. (2017), poverty and income distribution I India, juggernaut, New Delhi.
5. Prakash B.A (2009) , The Indian Economy since 1991, Edited Book, Pearson Education New Delhi.
6. Iswar C. Dhinkara, (2009) , The Indian Economy: Environment and Policy, Sultan Chand and Co.
7. Manmohan Agarwal and Amit shovon Toy, (2007) ,Globalisation and the Millinnium Development Goals, Orient Black Swan, Hyderabad.
8. Brahmananda, P. R, and V. R. Panchmuki (Eds) (2001), Development Experience in the Indian Economy: Inter-state Respective, Bookwell, Delhi.
9. Ahluwalia, I. J and I. M. D. Little (Eds) , (1999), India's Economic Reforms and Development, oxford Universities Press, New Delhi.

10. Agarwal, A.N, (1981), Indian Economy, Vishwa prakashan, New Delhi.

Web Sources

<https://www.vedantu.com/commerce/national-income>

https://en.m.wikipedia.org/wiki/Demographics_of_India

<https://en.m.wikipedia.org/wiki/Federation>

DEPARTMENT OF COMMERCE - PG - CBCS - LOCF

Title of the Paper: Entrepreneurship Development (NME)	Semester: III
Course Code: LPCONM31	Contact Hours: 5hrs/w
	Credit: 4

Course Learning Outcome:

On completion of the course, the students are able to

- know the factors affecting entrepreneurial growth.
- identify the problems faced by women entrepreneurs.
- identify the various institutional support to the entrepreneur.
- advocate for subsidy and incentives to be received from the Government.
- prepare the project reports.

Pre-required knowledge:

- ✓ Entrepreneurial venture
- ✓ Scope for women entrepreneurship
- ✓ Financial assistance from government

Unit- I: Introduction to Entrepreneurs

Entrepreneur - Definition - Concept - Characteristics - Qualities - Classification of entrepreneurs - Entrepreneur Vs Manager - Role of Entrepreneurs in the economic development -- Factors affecting entrepreneurial growth.

Entrepreneurship- Concept - Distinction between Entrepreneur and Entrepreneurship

Unit- II: Women Entrepreneurs

Introduction - Definition - Problems - Suggestions to overcome - Government steps towards Women Entrepreneurs - Institutions support to women Entrepreneurs in India.

Entrepreneurship Development Programmes (EDP):

Meaning - Objectives - Stages in EDP- Pre-training Stage - Training phase - Post Training - Evaluation and Feedback of EDP.

Unit- III : Assistance to Entrepreneurs:

Financial and Non-Financial Institutions - TIIC and SFC - DIC - SIDBI - SIDCO - Commercial Banks.

Unit- VI : Incentives and Subsidies:

Incentives and subsidies of State and Central Govt - Objectives -Aims - Tax Concession - Assistance to MSME's - Backward areas - Industrial Estates

Unit-V : Project Report:

Meaning - Steps - Contents - Reasons for failure of a Project Report – Format – Guidelines.

Suggested Topics/Practical Exercises:

The learners are required to

- ✓ list the various factors affecting entrepreneurial growth.
- ✓ explain the steps to overcome the problem face by women entrepreneur.
- ✓ name any two financial institutions supporting entrepreneurs to grow in Tamilnadu.
- ✓ cite examples for the growth of business using Seed Capital Assistance / Scheme.
- ✓ draw a project report for a new business concern.

Suggested Readings:

(i) Text Books

1. Gupta.C.B. (2018). Entrepreneurship Development. New Delhi: Sultan Chand and Sons.
2. Gordon. E. and Dr. Natarajan. K. (2020). Entrepreneurship Development. Mumbai: Himalaya Publishing House.

(ii) Reference Books

1. Gupta . C.B.& Srinivasan. N.P. (2018), Entrepreneurship Development. New Delhi: Sultan Chand and Sons.

2. Khanka S.S. (2018) Entrepreneurial Development. New Delhi: S.Chand & Company Ltd..
3. Kanishka Bedi. (2012). Management and Entrepreneurship, New Delhi: Oxford University Press.

(iii) Web-Sources:

1. www.tiic.in
2. www.sidco.in
3. www.dic.in

DEPARTMENT OF MATHEMATICS – PG – CBCS - LOCF

Title of the Course: Mathematics for Competitive Examinations (NME) Semester: III

Course Code: LPMSNM31 Contact Hours : 5hrs/w Credits: 4

Course Learning Outcomes:

- On completion of the course, the students are able to
- formulate the problem quantitatively
 - recall appropriate arithmetical methods to solve the problem
 - demonstrate various principles involved in solving mathematical problems.
 - evaluate various real life situations by resorting to analysis of key issues and factors
 - develop various mathematical skills to solve the problems

Pre-required Knowledge:

- ✓ Addition and subtraction
- ✓ multiplication and division
- ✓ product tables

Unit I:Quantitative Aptitude - I

HCF and LCM of numbers-Decimal Fractions – Simplification - Average-Problems on numbers-Problems on ages.

Unit II: Quantitative Aptitude – II

Percentage-Profit and loss-Ratio and proportion- Partnership-Simple interest-Compound interest.

Unit III: Quantitative Aptitude - III

Time and work-Time and distance-Problems on trains- Alligator or mixture.

Unit IV: Quantitative Aptitude and logic

Calendar – Clocks – Stock and shares - Odd man out and series.

Unit V: Reasoning

Verbal and non-verbal reasoning- verbal Reasoning – Analogy - Mathematical operations – Inserting the character. Non-Verbal Reasoning – Analytical Reasoning

Suggested Topics for Group Discussion/ Presentations:

1. Simplification
2. Simple and compound interest
3. Problems on trains
4. Stock and shares
5. Non-verbal reasoning

Suggested Readings:

(i) Text Books:

1. R.S. Agarwal, Quantitative Aptitude for Competitive Examinations Revised and Enlarged edition, S.Chand Publications, New Delhi, Reprint 2007.
2. R.S. Agarwal, Verbal and Non-Verbal reasoning S.Chand Publications, New Delhi, Reprint 2009.

Unit I: Book1: Section 2,3,4,6,7& 8.

Unit II: Section 10,11,12,13,21 & 22.

Unit III: Section 15,17,18& 20.

Unit IV: Section 27,28,29 & 35.

Unit V: Book 2: Part I – Section I- 2,13 & 16. Part II – Section – 4

(ii) Reference books:

1. R.Gupta, Quantitative Aptitude, Unique Publishers Pvt. Ltd, 2013.
2. Arora. P.N. and Arora. S., Quantitative Aptitude Mathematics, Volume-1 S Chand & Company Ltd., New Delhi, 2009.
3. Kothari. C.R., Quantitative Techniques, Vikas Publishing House Pvt. Ltd., New Delhi, 1989.
4. Srinivasan. T.M., Perumalswamy. S. and Gopala Krishnan. M.D., Elements of Quantitative Techniques, Emerald Publishers, Chennai, 1985.

(iii) Web Resources:

1. <https://mathematician0.weebly.com/>
2. <https://youtu.be/rHzggZDd4>
3. <https://youtu.be/ZADjT-wsQJw>
4. <https://youtu.be/ETiRE7N7pEI>
5. <https://www.youtube.com/watch?v=tnC9ojlTRg4&list=PLpyc33gOcbVA4qXMoQ5vmhefTruk5t9It>

DEPARTMENT OF CHEMISTRY – PG – CBCS-LOCF

Title of the paper: CHEMISTRY FOR ALL (NME)	Semester: III
Course Code: LPCHNM31	Contact Hours: 5hrs/w
	Credits: 4

Course Learning Outcomes:

On completion of the course, the students are able to

- ✓ know the basic chemistry involving types of elements and chemical reactions.
- ✓ study different concepts of acids and bases and various chemical processes
- ✓ gain awareness on Pollution and types of pollution
- ✓ know the details of plastics, glass, cement, types of fuels
- ✓ gain knowledge in vitamins, food adulterants and Classification and biological functions of antibiotics

Pre-Required Knowledge

- ✓ Properties of Metals and non-metals
- ✓ Isotopes, Isobar and isotones
- ✓ Stability of Colloidal solution
- ✓ Thermosetting and thermoplastics
- ✓ Green house effect and global warning

Unit I: BASIC CHEMISTRY- I

Elements – atoms and molecules – Metals and non metal – metalloids, alloy, ore and minerals - Chemical formulae and symbols – Important basic terms such as pressure, volume, atomic mass, molecular mass, temperature, atomic number – Types of chemical reactions (exothermic and endothermic, Physical and chemical changes, oxidation and reduction) – ideal and real gas - Important laws of Chemistry (Boyle's law, Charles's law, Hess's law, Graham's law of diffusion, Beer's law, Henry's law, Faraday's law, Law of conservation of matter or energy).

Unit II: BASIC CHEMISTRY- II: (Only elementary idea can be given)

Different concepts of Acids and Bases (Arrhenius, Bronsted and Lewis) – pH concept (no calculation) – Water – Hard and soft water - Chemical nature of metals- Steel and iron (no manufacture) – heat treatment of steel – Solutions and their types (True, Colloidal and suspension) – uses of colloidal solution – Buffer solution – Nuclear Chemistry – isotopes and radioactivity Definitions of some important chemical processes (Haber's, Contact's, Ostwald's, Processes)

Unit III: ENVIRONMENTAL CHEMISTRY

Pollution and types of pollution – Composition of atmosphere – Major regions of atmosphere and their characteristics – Elementary idea of Green house effects and Acid rain – Air pollution – Control of air pollution and their harmful effects – CFC, Global warming, substitute for CFC (Just name only)-Water pollution – Dissolved oxygen – BOD, COD and TDS (elementary idea only)

Unit IV: CHEMISTRY IN SERVICE OF MAN –I: (Only elementary idea can be given)

Plastics – Classification with examples – Polymer (natural and synthetic) – Soaps and Glass – Annealing of glass – Cement – Constituents and setting and hardening of cement – Rubber – Types with examples and vulcanization of rubber- Corrosion of metal – prevention – Lubricants (definition and classification) – Fuel – Classification with suitable examples - calorific value – LPG and Rocket fuel.

Unit V: Chemistry in service of man –II: (Only elementary idea can be given)

Food adulterants – common food adulterants and their harmful effects and tests to identify them– Classification and biological functions of Vitamins A, B6, B12, C, D, E and K (structural elucidation not required) – Classification and biological functions of antibiotics – penicillin, chloroamphenicol, streptomycin and tetracycline.

Suggested Topics For Group Discussion/ Presentations

- ✓ Metals and nonmetal
- ✓ Steel and iron
- ✓ Green house effects
- ✓ vulcanization of rubber
- ✓ organic and Inorganic pesticides

Suggested Readings

Text Books:

1. A Text book of Environmental Chemistry, O.D.Tyagi, M. Mehra, Anmol Publication, 1990.
2. Puri, Sharma and Pathania, Principles of Physical Chemistry, Vishal Publishing Co., 2004
3. Puri, Sharma and Pathania, Principles of Inorganic Chemistry, Vishal Publishing Co., 2004

Reference Books:

1. Applied Chemistry, K. BagawathiSundari, MJP Publishers, Chennai – 2006.

2. General Studies Manual, The TMH Publishers, 2008
3. Basic concepts of chemistry (HB) by Pegasus sold by Amazon Asia-Pacific Holdings Private Limited, 2018.

Websites and e-Learning Sources:

1. <https://youtu.be/eJXL0IrbtqE>
2. <https://2012books.lardbucket.org/pdfs/beginning-chemistry.pdf>
3. <https://youtu.be/J0v3stz7izA>
4. <https://youtu.be/EyBkPwsRY2E>
5. https://youtu.be/yU3GwJu_yNA
6. <https://youtu.be/uMBeXHnWhsE>
7. https://youtu.be/luUg7r7fu_eo
8. <https://youtu.be/eJXL0IrbtqE>

DEPARTMENT OF BOTANY - PG - CBCS - LOCF

Title of the Course: Plants and Human Welfare (NME)	Semester: III
Course Code: LPBYNM31	Contact hours: 5hrs/w
	Credit: 4

Course Learning Outcomes:

On completion of the course, the students are able to

- acquire knowledge on Plants as food
- understand the cultivation of mushrooms.
- recognize the need of plant drugs.
- familiarize with the wood and its types.
- come to know about the Organic farming.

Pre-required knowledge:

- Plant groups
- Raw drugs
- Farming techniques

Unit I: Plants as food

Importance of plant genetic resources and utilization. Present status of resources in India. Agricultural, vegetable, horticultural and medicinal plants. Higher plants as food - Cereals- Rice, Pulses- Pigeon pea.

Unit II: Cultivation of mushrooms – *Pleurotus*

General characters of mushroom – present status of the mushroom industry in India common edible and non-edible mushrooms. Nutritive and Energy value of edible mushrooms.

Unit III: Biological Drugs

Brief history and scope of raw drugs of plant origins. Definition, herbals, classification and description. Classification of vegetable drugs. Biological sources of drugs.

Unit IV: Timbers

Structure of wood, sap wood – heart wood transition, properties of wood (Physical, chemical & mechanical). Dendrochronology and its significance. Commercial uses of woods of South India - Teak (*Tectona grandis*), Neem (*Azadirachta indica*).

Unit V: Organic farming

Organic farming, vermin-composting. Leguminous plants in green manuring. Biofertilizer -*Rhizobium* and Blue green algae (*Nostoc*); Biopesticides: *Bacillus thuringiensis*.

Suggested Topics for Seminar/Presentation/Group Discussion:

- Plants as food
- Recent methods for mushroom cultivation
- Biological sources of drugs
- Dendrochronology and its significance
- Techniques of vermicomposting and Methods of organic farming

Suggested Readings:

Text Books:

1. Albert F. Hill. (1952). Economic Botany. Tata McGraw-Hill Publishing Company Ltd., New Delhi.
2. Pradeep Sachdeva. (2014). A Naturalists Guide to the Trees & Shrubs of India. *Prakash books* Publishers, Chennai. ISBN: 978817599408.

3. Board Eiri (2008) Hand Book of Tree Farming. *Engineers India Research Institute Publishers*. New Delhi.
4. Suman, B.C. & Sharma, V.P. (2007). Mushroom cultivation in India. *DayaPublishingHouse*, Delhi.

Reference Books

1. Dorian Q. Fuller, Eleni Asouti.(2008)Trees and Woodlands of South India. *Munshiram Manoharlal Publishers*. New Delhi. ISBN: 9788121512145.
2. Sanjay Tiwari, and Nikhil Devasar. (2019). 100 Indian Trees: The Big Little Nature Book. *DK India publishers*, New Delhi.
3. NeginhalS.G. (2020). Forest Trees of South India. *Notion Press publishers*, Chennai.
4. Diego Cunha Zied, Arturo Pardo-GimAcnez. (2017). Edible and Medicinal Mushrooms: Technology and Applications. *John Wiley & Sons*.
5. Kochhar, S.L. (1981). Economic Botany in the Tropics. *McMillan India Ltd.*, Madras.
6. Mukharjee, S.K. (1969). Survey of Plants of India. *Bull. Botanical Survey India*, 11(3): 217-223.
7. Sambamurthy, A.V.S.S. and N.S. Subramaniam. (1989). A Textbook of Economic Botany. *Wily Eastern Ltd.*, New Delhi.
8. Albert E Hill and O P Sharma (1996). Economic Botany. *Tata McGraw Hill Co. Ltd.*, New Delhi.
9. Anonymous. (1948-1976). The Wealth of India - A Dictionary of Indian Raw Materials and Industrial Products. Vol. I to X. *Publication and Information Directorate, CSIR*, New Delhi.

Web Sources:

1. <https://byjus.com/biology/food-sources-animal-plant-products/>
2. <https://foodplantsinternational.com/>
3. https://namyco.org/mushroom_cultivation_resources.php

4. <https://www.fs.fed.us/wildflowers/ethnobotany/medicinal/index.shtml>

DEPARTMENT OF PHYSICS – PG – CBCS - LOCF

Title of the Course: Physics for Competitive Examinations (NME) **Semester: III**

Course Code: LPPNHM31 Contact Hours: 5hrs/w Credit: 4

Course Learning Outcomes:

On completion of the course, the students are able to

- understand various systems of units and newton's laws of motion
- acquire the basic knowledge on gravitation
- understand the various aspects in electrostatics and electricity
- have knowledge on various properties of light
- understand the electronic devices, circuits and various number systems

Pre-Required Knowledge:

- ✓ Gravitational force, acceleration due to gravity mass and other physical quantities
- ✓ Heat, energy, temperature, basic mathematics, basic ideas on charge and current
- ✓ Elementary idea on planetary systems and space

Unit I: Systems of Units and Newton's Laws

System of units S.I.- Fundamental units- derived units – Dimension of physical quantity – uses of dimensional equations – limitation of dimensional analysis. Force and inertia, Newton's first law of motion – momentum – second law of motion – conservation of linear momentum – Newton's Third law of motion – friction – laws of limiting friction – static and dynamic friction.

Unit II: Gravitation

Gravitation-Kepler's law of planetary motion – universal law of gravitation – acceleration due to gravity – variation of 'g'

at poles – equator – Altitude – depth – rotation of earth – difference between mass and weight – Inertial mass and gravitational mass – Satellite – Orbital velocity – escape velocity – Rocket.

Unit III: Electrostatics and Electricity

Charge and fields – Coulomb's law – electric field due to a point charge – Gauss law – Application of Gauss law – Electric field due to parallel sheet of charge – Electric potential – Potential due to a point charge – Capacitor – Principle of a capacitor – Capacitance of a parallel plate capacitor – Effect of dielectric on capacitance – current and resistance – Electric current – Current density – Expression for current density – Ohm's law and electrical conductivity – Kirchoff's law – Application of Kirchoff's law to Wheatstone network and measurement of resistance.

Unit IV: Optics and Sound

Light – Reflection of light – Laws of reflection – Refraction of light – Laws of refraction – Dispersion visible range dual nature – Total internal reflection – Laser – Interaction of light with matter – Population inversion - Applications of laser. Simple Harmonic motion – Progressive wave properties – stationary waves – properties – ultrasonic – Properties and applications.

Unit V: Electronics

Difference between conductor, insulator and semiconductor using band theory – Intrinsic and extrinsic semiconductor – semiconductor diode – diode as a rectifier – Photo diode – LED – Zener diode as a voltage regulator – Number system – Binary, octal, Hexadecimal – Inter conversion – Cray code – exes 3 code , ASCII code – Basic gates – De-Morgan's theorem – Universal gates – Binary addition – Binary subtraction – 2's complement method - 1's complement method – binary multiplication – binary division.

Suggested Topics for Group Discussion/Presentation:

- ✓ Newton's laws of motion, concept of friction and its associated quantities

- ✓ Newton's law of Gravitation-Kepler's law of planetary motion,
- ✓ Electrostatics force, Electric field, electric potential, capacitors. Ohm's law Kirchoff's law
- ✓ Various properties of light, laser fundamentals and applications, Ultrasonics and applications.
- ✓ Various types of semiconductor devices, binary number systems

Suggested Readings:

(i) Text Books:

1. Murugesan, R. Mechanics, Properties of matter and sound. For Bsc ancillary physics, Reprint (2016).
2. Murugesan, R. Optics, Spectroscopy and Modern Physics, For Bsc ancillary physics, 1st edition (2017).
3. Murugesan, R. Electricity and electronics, for B.Sc Ancillary Physics, 1st edition, (2014).

(ii) Reference Book:

Halliday, D. Resnick, R and Walker, J. Principle of Physics, International Student version, Wiley India Private Ltd., 9th edition, reprint (2012).

(iii) Web Sources:

1. <https://www.khanacademy.org/science/physics>
2. https://ocw.uci.edu/courses/physics_3a_basic_physics.html
3. <https://www.concepts-of-physics.com/dr-hc-verma/videos.php#hc-verma-videos-on-mechanics>

Title of the Course: Linear Models and Design of Experiments	Semester: IV
Course Code: LPSTCT41	Contact Hours: 5
	Credits: 5

Course Learning Outcomes:

On completion of this course, the students will be able to

- develop the familiarity with linear mixed models of

estimation and large sample inference functions of techniques related problems.

- gain knowledge of one way and two-way analysis of variance.
- analyze the experimental designs and experimental data.
- understand the basic concept of an experimental design.
- apply the statistical interpretation of the experimental of randomized block design.

Pre Required Knowledge:

- ✓ Use and understand generalizations of the linear models to binary and count data.
- ✓ Understand the basic terms used in design of experiments.
- ✓ Apply the principles and theory of designing experiments.

Unit I: Random Vectors and Matrices

Introduction – Mean, Variances, Co-variances and Correlations – Means Vector and Covariance Matrices for Random Vectors – Correlation Matrices – Mean Vectors and Covariance Matrices for Partitioned Random Vectors – Linear Functions of Random Vectors.

Unit II: Linear Mixed Models

Introduction – The Linear Mixed Model – Examples – Estimation of Variance Components.

Unit III: The 2^k Factorial Design

Introduction – The 2^2 Design – The 2^3 Design – The General 2^k Design.

Unit IV: Blocking and Confounding in the 2^k Factorial Design

Introduction – Blocking a Replicated 2^k Factorial Design – Confounding in the 2^k Factorial Design – Confounding the 2^k Factorial Design in Two Blocks – Another Illustration of Why Blocking Is Important – Confounding the 2^k Factorial Design in Four Blocks –

Confounding the 2^k Factorial Design in 2^p Blocks – Partial Confounding.

Unit V: Additional Design and Analysis Topics for Factorial

The 3^k Factorial Design – Confounding in the 3^k Factorial Design – Fractional Replication of the 3^k Factorial Design.

Suggested Topics for Group Discussion/ Presentation

- ✓ Correlation Matrices.
- ✓ The Linear Mixed Model.
- ✓ The General 2^k Design.
- ✓ Partial Confounding.
- ✓ Confounding in the 3^k Factorial Design.

Suggested Readings:

i) Text Books:

1. Alvin C. Rencher, and G. Bruce Schaalje, Linear Models in Statistics, Second Edition, John Wiley & Sons, New York 2008.

Unit I : Chapter 3 : Sections 3.1 to 3.6

Unit II : Chapter 17 : Sections 17.1 to 17.4

2. Douglas C. Montgomery, Design and Analysis of Experiments, Eighth Edition, John Wiley and Sons, Inc. 2013.

Unit III : Chapter 6 : Sections 6.1 to 6.4

Unit IV : Chapter 7 : Sections 7.1 to 7.8

Unit V : Chapter 9 : Sections 9.1 to 9.3

ii) Reference Books:

1. S. C Gupta and V. K. Kapoor, Fundamentals of Applied Statistics, Sultan Chand and Sons (P), New Delhi, 2007.
2. G. B. Wetherill, Regression Analysis, 1986.
3. N. C. Giri, Analysis of Variance, South Asian Publisher, New Delhi, 1986.

4. Parimal Mukhopadhyay, Applied Statistics, Second Edition, Books and Allied (P) Ltd, Reprinted 2018.

iii) Web Sources:

1. https://www.youtube.com/watch?v=MKdl_phjEXA
2. <https://www.youtube.com/watch?v=-DnJw2PnX0c>
3. <https://www.youtube.com/watch?v=ZIX45lu7yUE>
4. <https://www.youtube.com/watch?v=GhWZmIClb38>
5. <https://www.youtube.com/watch?v=wK41TtZYJQI>

Title of the Course: Advanced Operations Research Semester: IV
Course Code: LPSTCT42 Contact Hours: 5 Credits: 5

Course Learning Outcomes:

On completion of the course, the students are able to

- identify and develop operations research is used for defense capability acquisition decision making.
- develop a skill set for quality and process improvement.
- give an appreciation of strategic importance of operations and supply chain management in a global business environment.
- apply the report that describes the model and the solving technique analyze.
- analyze of the basic concepts in non-linear programming.

Pre – Required Knowledge:

- ✓ Basic concepts of Linear Programming Problem and its solving methods.
- ✓ Fundamentals about constraints and Poisson distribution.
- ✓ Basics of models & queuing models.

Unit I: Network Model

Network Definitions – Minimal Spanning Algorithms – Shortest route Algorithms – Dijkstra's – Algorithms – Floyd's Algorithm – Maximal flow Algorithm.

Unit II: Constructions of Network Model

Network representation Critical Path (CPM) Computations
– Constructions of the Time Schedule – Determination of Floats.

Unit III: Deterministic Inventory Models

General Inventory Models – Static Economic Order Quantity (EOQ) Models – Classic EOQ Model – EOQ with Price Breaks – Multi-item EOQ with Storage Limitation.

Unit IV: Queuing systems

Generalized Poisson Queuing Model – Specialised Poisson Queues – Steady-State Measure of Performance – Single Server Models – $(M/M/1) : (GD/\infty/\infty)$, $(M/M/1) : (GD/N/\infty)$, Multi Server Models $(M/M/c) : (GD/\infty/\infty)$ – Machine Serving Model – $(M/M/R) : (GD/K/K), R < K$ – $(M/G/1) : (GD/\infty/\infty)$ – Pollaczek-Khintchine (P-K) Formula.

Unit V: Classical Optimization Theory

Unconstrained Problems – Constrained Problems – Nonlinear Programming Algorithms: Unconstrained Algorithms – Constrained Algorithms: Quadratic Programming.

Suggested Topics for Group Discussion/ Presentation

- ✓ Floyd's Algorithm.
- ✓ Determination of Floats
- ✓ Multi-item EOQ with Storage Limitation.
- ✓ Machine Serving Model.
- ✓ Unconstrained Algorithms.

Suggested Readings

i) Text Book:

1. Hamdy A. Taha, Operations Research, An Introduction, Seventh Edition, Printice-Hall of India (P) Ltd, New Delhi, 2005.

Unit I : Chapter 6 : Sections 6.1 to 6.3.2, 6.4 to 6.4.2

Unit II : Chapter 6 : Sections 6.6 to 6.6.3

Unit III : Chapter 11 : Sections 11.1, 11.2
Unit IV : Chapter 17 : Sections 17.5 to 17.7
Unit V : Chapter 20
Chapter 21 : Sections 21.1, 21.2.2

ii) Reference Books:

1. Prem Kumar Gupta D. S. Hira, Operations Research, S. Chand and Company Ltd, NewDelhi, 2007.
2. S.D.Sharma , Operations Research, Kedar Nath Ram Nath and Co, Meerut, India, 2003.
3. K. Swarup, M. Mohan, P. K. Gupta, Operations Research, Sultan Chand and Sons, NewDelhi, 2001.

iii) Web Sources:

1. <https://www.youtube.com/watch?v=Dmw3OsyT5yw>
2. <https://www.youtube.com/watch?v=H58TPQNr2kM>
3. <https://www.youtube.com/watch?v=uA-cR8nBP6E>
4. <https://www.youtube.com/watch?v=xGkpXk-AnWU>
5. <https://nptel.ac.in/courses/112/106/112106131/>

Title of the Course: Econometrics	Semester: IV
Course Code: LPSTCT43	Contact Hours: 5
	Credits: 5

Course Learning Outcomes:

On completion of the course, the students are able to

- develop knowledge on concepts of Econometrics, methodology and limitations of using Econometric theory.
- derive generalized least square estimators and its properties.
- demonstrate of variations and generalizations of the basic regression analysis.
- explore prominent estimation methods for simultaneous-equation models.
- familiarize the basic econometric techniques and their applications and equip them with a broad knowledge of estimation of simultaneous-equation models relevant for analyzing economic data.

Pre Required Knowledge:

- ✓ Basic knowledge of economics.
- ✓ Fundamental of correlation.
- ✓ Understanding of the linear equations.

**Unit I: Introduction – Econometrics and Methodology
Econometrics**

Definition and Scope of Econometrics – Relationship between Econometrics, Mathematical Economics and Statistics – Goals of Econometrics – Limitations – Methodology Econometrics – Stage I : Specification of the model – Stage II : Collection of data and estimation of the model – Stage III : Evaluation of the coefficient of the model – Stage IV : Forecasting power of the model – Theoretical and Applied Econometrics.

Unit II: Simple Linear Regression Model

Introduction – Stochastic and Non-Stochastic relations – Reasons for the inclusion of random variable – Assumptions of Linear stochastic regression model – The distribution of the dependent variable Y – Least Squares Estimation – Estimation of a function whose intercept is zero – Estimation of elasticities from an estimated regression – Desirable properties of estimators – Statistical Properties of Least Squares Estimators.

Unit III: Autocorrelation

Meaning of autocorrelation – Detecting the presence of autocorrelation – Causes of autocorrelation – Co-efficient of autocorrelation – The first order autoregressive scheme – Effects of autocorrelation on OLS estimator – Detection of autocorrelation.

Unit IV: Heteroscedasticity and Multicollinearity

Introduction – Graphical presentation of the problem of heteroscedasticity – Reasons for the problem of heteroscedasticity – Consequences of heteroscedasticity – Tests for heteroscedasticity - Reasons for the problem of multicollinearity – Consequences of multicollinearity – Tests of multicollinearity.

Unit V: Simultaneous-Equation Models and Simultaneous - Equation Methods

Definition – Simultaneous equation bias – Consequences of Simultaneous relations – Some definitions – The method of Indirect Least Squares (ILS) – Two Stage Least Squares method (2SLS).

Suggested Topics for Group Discussion/ Presentation

- ✓ Goals of Econometrics and Methodology Econometrics.
- ✓ Least Squares Estimation.
- ✓ Effects of autocorrelation on OLS estimator.
- ✓ Tests for heteroscedasticity and Consequences of multicollinearity.
- ✓ Problems of Simultaneous-equation Models

Suggested Readings:

i) Text Book:

1. S. Shyamala, Navdeep Kaur, T. Arul Pragasam, A text book on Econometrics Theory and Applications, Second Edition, Vishal Publishing Co., Jalandhar, Delhi, 2010.

Unit I	:	Chapter 1	Chapter 2
	:	Sections 1.1 to 1.5	
	:	Sections 2.1 to 2.5	
Unit II	:	Chapter 3	: Sections 3.1 to 3.10
Unit III	:	Chapter 6	: Sections 6.1 to 6.7
Unit IV	:	Chapter 7	Chapter 8
Unit V	:	Chapter 13	Chapter 15
	:	Sections 7.1 to 7.5	
	:	Sections 8.1 to 8.3	
	:	Sections 13.1 to 13.4	
	:	Sections 15.1 , 15.2	

ii) Reference Books:

1. G. M. K. Madhani, Introduction to Econometrics Principles and Applications, Eighth Edition, Oxford and IBH Publishing Co. Pvt. Ltd, New Delhi, 2008.

2. G. S. Maddala and KajaLagari, Introduction to Econometrics, Wiley, New York, 2009.
3. K. Dhanasekaran, Econometrics, Vrinda Publications (P), Ltd., 2006.

iii) Web Sources:

1. <https://youtu.be/DoBNfROpwFc>
2. <https://youtu.be/zRklTsY9w9c>
3. <https://youtu.be/O4jDva9B3fw>
4. <https://youtu.be/HfnFeJlkfZE>
5. <https://youtu.be/i0qPzIXfgW0>

Title of the Course: Practical for R Programming **Semester: IV**

Course Code: LPSTCL41 **Contact Hours: 5** **Credits: 2**

Course Learning Outcomes:

On completion of the course, the students are able to

- learning a programming language.
- access online resources for R and import new function packages into the R workspace.
- manipulate and summarize data-sets in R.
- gain knowledge in data types.
- perform appropriate statistical tests using R and create and edit visualizations with R.

List of Programs:

1. Import and Export data file in R.
2. Fundamental of data frame in R.
3. Descriptive statistics in R.
4. Attach and Detach data frame.
5. Add new columns and new rows to the data frame.
6. Bar plot and histogram.
7. Box plot to show outlines present in the data.
8. Correlation and plot the variable using scatter diagram.
9. Regression analysis in R.

10. Simple (One-Way) ANOVA in R.
11. One sample, Two sample test, Paired sample t- test
12. Matrix (by row 1st, by column 1st) in R.
13. Fitting of Poisson distribution in R.
14. Fitting of Binomial distribution in R.
15. Fitting of Normal distribution in R.
16. Non-parametric distribution in R.

Title of the Course: Project and Viva-Voce/ Dissertation	Semester: IV
Course Code: LPSTPJ41	Contact Hours: 4
	Credits: 4

Course Learning Outcomes:

On completion of the course, the students are able to

- develop original thinking for formulating new problems and providing their solutions.
- understand should be sensitive to real experiences with respect to self, society and nation.
- analyze and interpret and take appropriate decisions in solving real life problems using statistical tools.
- use different Statistical package for graphical interface, data analysis and interpretations, write a systematic Statistical project report.
- be familiar with data collection, compilation, analysis and interpretation and writing of project reports independently.

Procedure:

1. Each student will be allotted a project Guide from the faculty of the Department concerned.
2. After the completion of the project work, the student has to submit four copies of project with report carrying his/her project report.
3. Project work will be evaluated by both external and the internal (Project Guide) examiners for the maximum of 100 marks in total on the scale of the maximum of 50 marks for the internal and the external each.

4. Viva-voce will be conducted by the panel comprising HOD, External examiner and Project Guide for the maximum of 100 marks in total on the scale of the maximum of 50 marks for the internal and the external each.

Title of the Course: Statistical Practical – III & IV **Semester: IV**
(Calculated based)

Course Code: LPSTD41 **Contact Hours: 4** **Credits: 3**

Course Learning Outcomes:

On completion of the course, the students are able to


- classify the sample space as acceptance and rejection regions.
- apply the statistical interpretation of the experimental of randomized block design.
- gain knowledge of the test statistical hypothesis errors.
- formulate the inventory problems and solve various types of models.
- improve trend with the statistical models based on statistical analysis.

List of Programs:

i) Testing Statistical Hypotheses

1. Test of hypothesis of critical region and level of significance.
2. Test of hypotheses testing in errors.
3. Test of significance of equality of two variances from normal distribution.
4. Test of significance of correlation coefficients.
5. Sequential hypothesis testing.

ii) Statistical Quality Control

1. Control charts for \bar{x} and R 
2. Control chart for number of defectives d-chart and c-chart.

3. The exponentially weighted moving average control chart.
4. The acceptance-sampling problem.
5. Measurement of reliability.

iii) Advanced Operations Research

1. PERT network model.
2. EOQ models.
3. Inventory models.
4. Queuing models.
5. Non-linear Programming Problem.

iv) Design of Experiments

1. 2² Factorial Experiments.
2. 2³ Factorial Experiments.
3. 3² Factorial Experiments.
4. Confounding in the 3^k Factorial Design.
5. Balanced Incomplete block Design.

Title of the Course: Practical for Visual Basic Programming	Semester: IV
Course Code: LPSTDL42	Contact Hours: 4
	Credits: 3

Course Learning Outcomes:

On completion of the course, the students are able to

- learning a programming language.
- access online resources for visual basic and import new function packages into the visual basic workspace.
- manipulate and summarize data-sets in visual basic.
- gain knowledge in data types.
- perform appropriate statistical tests using visual basic and create and edit visualizations with visual basic.

List of Programs:

1. Design a Calculator in visual basic.
2. Design a Clock in visual basic.

3. Menu Creation – with simple file and edit options in visual basic.
4. Designing a color mixer using basic colors in visual basic.
5. Picture Animation in visual basic.
6. Creative a file open dialogue box to load a picture in visual basic.
7. View records using data control in visual basic.
8. Adding records to database using data control in visual basic.
9. Descriptive statistics in visual basic.
10. Bar plot and histogram in visual basic.
11. Correlation and plot the variable using scatter diagram in visual basic.
12. Regression analysis in visual basic.
13. Fitting of Poisson distribution in visual basic.
14. Fitting of Binomial distribution in visual basic.
15. Fitting of Normal distribution in visual basic.
16. Non-parametric distribution in visual basic.

Title of the Course: Bio-Statistics

Semester: IV

Course Code: LPSTSE41

Contact Hours: 2

Credits: 2

Course Learning Outcomes:

On completion of the course, the students are able to

- gain knowledge collection of methods and techniques in statistics applied in the field of health science.
- focus on estimating risk associated to drug interventions or treatment procedures or exposure.
- impart the applications of statistical measures in health sciences.
- formulate hypotheses and perform statistical analysis for biological problems.
- apply various techniques death rates and life tables.

Pre Required Knowledge:

- ✓ Basic knowledge of estimation, hypothesis, frequency distributions.
- ✓ Fundamental ideas the collection of data.
- ✓ Basic concepts health is a function of social, economic and political.

Unit I: Scope of Statistical Methods in Medicine, Clinical Medicine, Preventive Medicine

Introduction – Problems of estimation – Tests of hypothesis – Experimental setting – Introduction – Some examples of earlier use of statistics – Areas of application of statistics – Introduction – Some early examples – Areas of application – Introduction – Some essential features – Data recorded in routine clinical practice – Qualitative and Quantitative observation – Scale of Measurement.

Unit II: Non-parametric and Statistical Methods

Introduction – Advantages of non-parametric tests – Disadvantages of non-parametric tests – Some non-parametric tests – Some illustrations – Introduction – Stochastic models in medicine – Biological assay – Sequential medical trials.

Unit III: Vital Statistics

Introduction – Uses of vital statistics – Mechanism for collection of vital statistics – Basic formulae for calculation of vital statistics – Mortality rates – Fertility rates.

Unit IV: Health Statistics

Introduction – Utilization of the basic data – Sources of health statistics – Problems in the collection of sickness data – Measurement of sickness – Hospital statistics – International classification of diseases.

Unit V: Standardized Death Rates and Life Tables

Introduction – Adjusted or Standardized rates – Life tables.

Suggested Topics for Group Discussion/ Presentation

- ✓ Data recorded in routine clinical practice.
- ✓ Stochastic models in medicine.
- ✓ Mechanism for collection of vital statistics.
- ✓ Sources of health statistics.
- ✓ Life tables.

Suggested Readings:

i) Text Book:

1. P. S. S. Sundar Rao and J. Richard, An Introduction to Biostatistics, Third Edition, Prentice-Hall of India, Private Limited, new Delhi, 2003.

Unit I	:	Chapters 1 to 4
Unit II	:	Chapters 16 and 17
Unit III	:	Chapter 18
Unit IV	:	Chapter 19
Unit V	:	Chapter 20

ii) Reference Books:

1. W. David Wayne, A foundation for analysis in health sciences, Fourth Edition, JohnWiley and Sons, 1987.
2. J. R. Jain, Statistical techniques in quantitative genetics, Tata McGraw Hill, 1982.
3. J. Susan Milton, Statistical methods in the biological and health science, McGraw Hill, 1992.

iii) Websites Sources:

1. https://translate.google.com/translate?hl=ta&sl=en&u=https://nptel.ac.in/courses/10_2101056&prev=search&pto=aue
2. <https://nptel.ac.in/courses/111/102/111102143/>
3. <https://www.analyticssteps.com/blogs/what-vital-statistics-types-uses-examples>
4. <https://nptel.ac.in/courses/109106095>
5. <https://www.youtube.com/watch?v=0cvQd6sdpgg>

Title of the Course: Survey Analysis

Semester: IV

Course Code: LPSTSE42

Contact Hours: 2

Credits: 2

Course Learning Outcomes:

On completion of the course, the students are able to

- understand for analyzing complex sample survey data.
- apply the new review of software packages for analyzing complex sample survey data has been published.
- appreciation of model diagnostics, goodness of fit tests, and the estimate and display of marginal effects in linear and extended linear models.
- develop the analysis of complex sample survey data.
- formulate the basic concepts of framework for Analysis of categorical survey data.

Pre Required Knowledge:

- ✓ Fundamentals random sampling, populations and probability distributions.
- ✓ Basics of data collection and its types.
- ✓ Basic idea about bivariate and multivariate distributions.

Unit I: Complex Sample Design

Introduction – Classification of Sample Designs – Target Populations and Survey Populations – Simple Random Sampling – Complex Sample Design Effects.

Unit II: Foundation and Techniques for Design-Based Estimation and Inference

Introduction – Finite Populations and Super Population Models – Confidence Intervals for Population Parameters – Weighted Estimation of Population Parameters – Probability Distributions and Design-Based Inference.

Unit III: Preparation for Complex Sample Survey Data Analysis

Introduction – Analysis Weights – Understanding and Checking the Sample Error Calculation Model – Addressing Item Missing Data in Analysis Variables – Preparing to

Analyze Data for Sample Subpopulations – A Final Checklist for Data Users.

Unit IV: Descriptive Analysis for Continuous Variables

Introduction – Special Consideration in Descriptive Analysis of Complex Sample Survey Data – Simple Statistics for Univariate Continuous Distributions – Bivariate Relationships between Two Continuous Variables.

Unit V: Categorical Data Analysis

Introduction – A Framework for Analysis of Categorical Survey Data – Univariate Analysis of Categorical Data – Bivariate Analysis of Categorical Data - Analysis of Multivariate Categorical Data.

Suggested Topics for Group Discussion/ Presentation

- ✓ Simple Random Sampling.
- ✓ Probability Distributions and Design.
- ✓ A Final Checklist for Data Users.
- ✓ Bivariate Relationships between Two Continuous Variables.
- ✓ Bivariate Analysis of Categorical Data.

Suggested Readings:

i) Text Book:

1. Steven G. Heeringa, Brady T. West & Patricia A. Berglund, Applied Survey Data Analysis, First Edition, CRC Press A Chapman & Hall Book, 2010.

Unit I : Chapter 2 : Sections 2.1 to 2.5

Unit II : Chapter 3 : Sections 3.1 to 3.5

Unit III : Chapter 4 : Sections 4.1 to 4.6

Unit IV : Chapter 5 : Sections 5.1 to 5.4

Unit V : Chapter 6 : Sections 6.1 to 6.5

ii) Reference Books:

1. R .L. Chambers and C. J. Skinner, Analysis of survey data, Wiley Series, 2002.

2. R. G. Miller, Survival Analysis, John Wiley & Sons, Inc. 1981.
3. B. Nelson, Applied life Data Analysis, Wiley Series, 2003.

iii) Web Sources:

1. https://www.youtube.com/watch?v=0jdU7FrueMo&list=PL2yD6frXhFob_Mvfg21Y01t_yu1aC9NnP
 2. <https://www.youtube.com/watch?v=rkZ2Oi0xffM>
 3. <https://www.youtube.com/watch?v=ag0L2bpK5pU>
 4. <https://www.youtube.com/watch?v=yfNys5ouM4c>
 5. <https://www.youtube.com/watch?v=WF6cvErdY2c>
-

RULES AND REGULATIONS FOR THE PROJECT / DISSERTATION WORK (UG, PG AND M.PHIL)

- Research supervisors will be allotted to the students / scholars by the respective Department.
- Research topic shall be chosen by the student / scholar in consultation with his/ her research supervisor.
- Every department has to maintain the year-wise list of project works carried out by the students. Research works done by the students / scholars of the previous batches should not be repeated by the students / scholars of the current academic year.
- The general structure of the project report is given below.
 - Title page with college emblem
 - Research supervisor's certificate
 - Student's declaration counter signed by Research Supervisor and the HOD
 - Student's Acknowledgement
 - Contents
 - List of Tables if any
 - Introduction
 - Review of Literature
 - Materials and Methods
 - Results and Discussion
 - Summary of Findings and Conclusion
 - Bibliography
 - Annexure
- Four copies of the project report should be submitted, typed in A4 Paper in Times New Roman with the font size of 12 and 1.5 line spacing.

SARASWATHI NARAYANAN COLLEGE

(Autonomous Institution – Affiliated to Madurai Kamaraj University)

(Reaccredited with B^(2.78) Grade by NAAC in the second cycle)

MADURAI -22

EVALUATION METHOD UNDER CBCS- LOCF

CONTINUOUS INTERNAL ASSESSMENT (CIA)

Internal assessment is based on the continuous evaluation of performance of the students in each semester. Internal mark is awarded to each course in accordance with the following guidelines.

UNDER GRADUATE, POST GRADUATE AND M.PHIL:

1. Internal test will be conducted for the maximum of 60 marks and converted to 15 marks.
2. Two internal tests will be conducted and the average of marks secured in the two tests will be taken as the Final Internal Test mark.
3. The distribution of Internal Assessment marks is given below.

THEORY			PRACTICAL		
Test	-	15	Record Note	-	10
Seminar	-	5	CIA	-	15
Quiz	-	5	Model Exam	-	15
		-----			-----
Internal Maximum	-	25	Internal Maximum	-	40
		-----			-----

4. There is no Cumulative Internal Assessment (CIA) for Self Learning. Courses, Add on Certificate / Diploma Programmes and Part-1 subjects other than Tamil.

5. Internal marks for those UG, PG and M.Phil. students who have to Repeat the Semester (RS) for want of attendance should be marked "AA" in the foil card.
6. There is no minimum mark for Internal assessments marks for all the UG, PG and M.Phil. Programmes.
7. Internal test for improvement of marks is not allowed under any circumstances
8. Special Internal Assessment tests for the absentees may be conducted on genuine reasons with the prior approval of HOD, Dean and Principal. Such tests may be conducted before the commencement of the Summative Examinations.

SUMMATIVE EXAMINATIONS (SE)

1. Summative Examinations for all the UG, PG and M.Phil. Programmes are conducted in November and April for the Odd and the Even semesters respectively.
2. Question paper setting along with the scheme of valuation is purely external for all the UG, PG and M.Phil. Programmes.
3. The office of the CEO is conferred with the right of choosing the Question Paper Setters and the External Examiners from the Panels suggested by the Boards of Studies of Programmes offered by the respective Department and approved by the Academic Council of the College. The question papers set for the Summative Examinations will be finalised by the Scrutiny Committee constituted by the office of the COE.
4. Practical Examinations will be conducted by the External Examiner and the course teacher, who will act as the Internal Examiner. In the absence of course teacher / External Examiner, HOD will act as the Internal Examiner / External Examiner.
5. The marks scored by the students in the External Examinations in Self Learning Courses and Add – on Courses will be converted to 100 for each course.
6. The theses submitted by the M.Phil. scholars after the conduct of Awards Committee meeting can be valued and the Viva-Voce Examinations can be conducted. The Principal is empowered to declare the results and it can be ratified in the next Awards Committee meeting.

**Knowledge levels for assessment of Outcomes
based on Blooms Taxonomy**

S. No	Level	Parameter Description	Description
1	K1	Remembering	Remembering It is the ability to remember the previously learned
2	K2	Understanding	The learner explains ideas or Concepts
3	K3	Applying	The learner uses information in a new way
4	K4	Analysing	The learner distinguishes among different parts
5	K5	Evaluating	The learner justifies a stand or decision
6	K6	Creating	The learner creates a new product or point of view

WEIGHTAGE OF K-LEVELS IN QUESTION PAPER

	K-LEVELS (Cognitive Level)					Total
	K1	K2	K3	K4	K5/ K6	
SUMMATIVE EXAMINATIONS– 75 Marks Pattern	21	30	18	18	13	100
SUMMATIVE EXAMINATIONS–50 Marks Pattern	24.5	24.5	17	17	17	100
CONTINUOUS INTERNAL ASSESSMENT(CIA)	24	26	14	25	11	100

QUESTION PATTERN FOR SUMMATIVE EXAMINATIONS For those who join in June 2022 UG and PG (Language Courses, Core Courses, Discipline Specific Electives, Generic Elective Courses, Non-Major Electives(PG))	
TOTAL MARKS 75	
<p style="text-align: center;">SECTION-A (Answer all questions)</p> <p>I. Choose the correct answer (FIVE questions –ONE question from each unit) (Q.No.1-5)-All questions are at K2 level</p> <p>II. Fill in the blanks (FIVE questions - ONE question from each unit) (5x1=5) (Q.No.6-10)-All questions are at K1 level</p>	10
<p style="text-align: center;">SECTION-B</p> <p>Answer all questions not exceeding 50 words each. ONE set of questions from each unit Q. No. : 11 to 15 (5x2=10)</p> <p>K2 level – 2 Questions K3 level – 1 Question K4 level –1 Question K5/K6 level – 1 Question</p>	10
<p style="text-align: center;">SECTION-C-Either/or type</p> <p>Answer all questions not exceeding 200 words each. ONE set of questions from each unit. Q. No. : 16 to 20 (5 x5=25)</p> <p>K1 level – 1 Question K2 level – 2 Questions K3 level – 1 Question K4 level – 1 Question</p>	25
<p style="text-align: center;">SECTION-D-Answer any THREE questions not exceeding 400 words each.</p> <p>ONE question from each unit. Q. No. : 21 to 25 (3x10=30)</p> <p>K1 level – 1 Question K2 level – 1 Question K3 level – 1 Question K4 level – 1 Question K5/K6 level – 1 Question</p>	30
Total	75

QUESTION PATTERN FOR SUMMATIVE EXAMINATIONS For those who join in June 2022 UG and PG (Skill Enhancement Courses, Self Learning Courses, Non Major Electives (UG) and Part V Courses (except NCC))	
TOTAL MARKS 50	
SECTION-A (Answer all questions)	
I. Choose the correct answer (FIVE questions – ONE question from each unit) (5x1=5) (Q.No.1-5)-All questions are at K2 level	10
II. Fill in the blanks (FIVE questions – ONE question from each unit) (5x1=5) (Q.No.6-10)-All questions are at K1 level	10
SECTION-B Answer all questions not exceeding 50 words each. ONE set of question from each unit Q. No. : 11 to 15 (5x2=10) K1 level – 1 Question K2 level – 1 Question K3 level – 1 Question K4 level – 1 Question K5/K6 level – 1 Question	10
SECTION-C Answer any THREE questions not exceeding 400 words each. ONE question from each unit Q. No. : 16 to 20 (3x10=30) K1 level – 1 Question K2 level – 1 Question K3 level – 1 Question K4 level – 1 Question K5/K6 level – 1 Question	30
Total	50

QUESTION PATTERN FOR INTERNAL ASSESSMENT (CIA)	
For those who join in June 2022 UG and PG	
TOTAL MARKS 60	
<p style="text-align: center;">SECTION-A(Answer all questions)</p> <p>I. Choose the correct answer (5 x 1 = 5) (Q.No.1-5)-All questions are at K2 level</p> <p>II. Fill in the blanks (5 x 1 = 5) (Q.No.6-10)-All questions are at K1 level</p>	10
<p>SECTION-B</p> <p>Answer all questions not exceeding 50 words each.</p> <p>ONE set of question from each unit (4 x 2 = 8) Q.No. 11 – K2 level Q.No. 12 – K3 level Q.No. 13 – K3 level Q.No. 14 – K5/ K6 level</p>	8
<p style="text-align: center;">SECTION-C-Either/or type</p> <p>(Answer all questions not exceeding 200 words each. (3 x 6 = 18) Q.No. 15 – K3 level Q.No. 16 – K4 level Q.No. 17 – K5/K6 level</p>	18
<p style="text-align: center;">SECTION-D</p> <p>Answer any TWO questions not exceeding 400 words each. (2 x 12 = 24) Q.No. 18 – K1 level Q.No. 19 – K2 level Q.No. 20 – K4 level</p>	24
Total	60

QUESTION PATTERN FOR SUMMATIVE EXAMINATIONS						
For those who join in June 2022 UG and PG						
(Language Courses, Core Courses, Discipline Specific Electives, Generic Elective Courses, Non-Major Electives (PG))						
DURATION:3HRS			MAXMARKS:75			
K-LEVELS	K1	K2	K3	K4	K5 / K6	TOTAL MARKS
SECTIONS						
SECTION A (Answer all questions, each question carries One Mark)	5	5				10
SECTION B (Answer all questions, each question carries TWO Marks, ONE question from Each unit)		4	2	2	2	10
SECTION C (Answer all questions- Either/or type-ONE Question from each unit)	5	10	5	5		25
SECTION D (Answer anyTHREE questions, ONE question from each unit, each question carries TEN Marks)	10	10	10	10	10	30
TOTAL	20	29	17	17	12	75

QUESTION PATTERN FOR SUMMATIVE EXAMINATIONS						
For those who join in June 2022						
UG and PG						
(Skill Enhancement Courses, Self Learning Courses, Non Major Electives (UG)and Part V Courses (except NCC))						
DURATION:2HRS				MAX MARKS:50		
K-LEVELS	K1	K2	K3	K4	K5/ K6	TOTAL MARKS
SECTIONS						
SECTION A (Answer all questions, each question carries One Mark)	5	5				10
SECTION B (Answer all questions, each question carries TWO Marks, ONE question from Each unit)	2	2	2	2	2	10
SECTION C (Answer any THREE questions, ONE question from each unit, each question carries TEN Marks)	10	10	10	10	10	30
TOTAL	17	17	12	12	12	50

BLUE PRINT OF QUESTION PAPER FOR INTERNAL ASSESSMENT (CIA)						
DURATION:2HRS				MAX MARKS:60		
K-LEVELS	K1	K2	K3	K4	K5/ K6	TOTAL MARKS
SECTIONS						
SECTION A (Answer all question. Each question Carries ONE Mark)	5	5				10
SECTION B (Answer all questions. Each question carries TWO Marks)		2	4		2	8
SECTION C (Answer all questions- Either/or type -Each question carries SIX Marks)			6	6	6	18
SECTION D (Answer any TWO questions. Each question carries TWELVE Marks)	12	12		12		24
TOTAL	17	19	10	18	8	60

VALUATION

1. Central valuation system is adopted.
2. Single Valuation system is followed for UG, PG and M.Phil. theory examinations. The valuation is done by the external examiners only.
3. UG and PG Practical Examinations are valued by both Internal and External Examiners.
4. Any discrepancy in the question paper should be brought to the notice of the Controller of Examinations by the respective Course Teacher through the Head of the Department within five days from the date of examination.

DECLARATION OF RESULTS

1. The total credit should not exceed 140 for UG Programmes and 90 for PG Programmes, excluding the credits earned for additional credit courses. This is applicable to the students migrating from other colleges also.
2. The students migrating from other colleges have to appear for the Summative Examinations conducted by the college for non-equivalent theory and practical courses. Mark scored by such a student in the Summative Examinations conducted by the previous college shall be converted to 100 if it is less than 100 for any equivalent course.
3. The students who repeat the semester have to appear not only for Summative Examinations but also for internal tests. The Internal marks scored by such students in their previous attempts shall stand invalid.
4. Results will be published within 20 days from the date of completion of all the Examinations.
5. Results will be declared as per the norms given in the following table in consultation with the Awards Committee.

Maximum and Passing Minimum Marks

Course	External Exam (SE)		Aggregate Marks (CIA + SE)	
	Passing Minimum	Maximum Mark	Passing Minimum	Maximum Mark
UG (Theory)	27	75	40	100
UG – NME / SEC / Part V (except NCC)	18	50 (converted to 75 marks)	40	100
UG – SLC	20	50	40	100
UG (Practicals)	21	60	40	100
UG Project	18	50	40	100
PG (Theory)	34	75	50	100
PG (Practicals)	27	60	50	100
PG (Project)	23	50	50	100
M.Phil. (Theory)	34	75	50	100
M.Phil. Project				
1. Dissertation	50	100 (Internal 50 + External 50)	-	-
2. Viva – Voce	50	100 (Internal 50 + External 50)	-	-

REVALUATION AND SUPPLEMENTARY EXAMINATIONS

1. Students can apply for Revaluation within 10 days from the date of the publication of the results.
2. Final year students of UG and PG Programmes can appear for Supplementary Examinations for the arrear papers of only the V and VI Semesters of UG Programmes and III and IV Semesters of PG Programmes. Students having the maximum of three arrear papers alone are eligible for Supplementary Examinations.
3. Absentees in the Summative Examinations are not eligible to apply for the Supplementary Examinations.
4. Supplementary Examinations will be conducted every year in the month of July.

ATTENDANCE

1. Students with the minimum of 75% of attendance (68 days out of 90 days) in a semester are permitted to appear for the summative examinations.
2. Students who do not have the minimum attendance should go for condonation.
3. Students who do not have the minimum attendance of 20 hrs for Certificate Programme and the minimum attendance of 20 hrs for each course in Diploma Programme will not be permitted to appear for the summative examinations.

The following are the regulations for grant of condonation.

Attendance	Condonation Fee	Authority to Consider	Nature of Penalty
65% - 74% (59-67 days)	Rs.500/-	Head of the Department	As decided by the HOD
50% - 64% (58-45 days)	Rs.1000/-	Principal and the Examination Committee	Application for exemption to be made on prescribed form with the specified remarks of the Principal
< 50% (Below 45 days)	To repeat the whole semester	-----	-----

EXAMINATION RULES AND REGULATIONS

1. Students without hall ticket and identity card are not permitted to appear for the examinations.
2. Possession of materials in any form for copying is strictly prohibited in the examination hall.
3. Students indulging in any form of malpractices in the examination are liable for severe punishment.
4. Students are not allowed into the examination hall after 30 minutes of the commencement of the examination.
5. Students should not write their names or any other identification marking except their register number in the answer scripts.
6. Students who have discontinued the Degree Programme are not permitted to write the summative examinations.
7. Students who have not completed the theory and practical courses during the Programme of their study are allowed to appear for the Summative Examinations in the same syllabi up to a period of three years from the year of the completion of Programme. However, after the completion of three years, they have to appear for the summative examinations for the equivalent course in the current syllabi only. The equivalence of a course is to be decided by the respective HOD, Dean, the Controller of Examinations and the Principal. This is also applicable to those students who repeat the semester.

**PENAL ACTIONS FOR VARIOUS FORMS OF
MALPRACTICES IN THE SUMMATIVE
EXAMINATIONS**

Sl. No.	Malpractice	Penal Action
1	In Possession of Materials relevant to the examination concerned	Cancellation of that particular paper.
2	Copied from materials in his/her possession	Cancellation of all papers of that semester
3	Copied from neighbours	Cancellation of all papers including arrear papers of that semester Cancellation of that particular paper of the candidate who helped for copying
4	Copied by exchanging answer script between neighbours	Cancellation of all papers of the candidates who exchanged their answer scripts
5	Misbehaviour in the examination hall	Cancellation of that particular paper
6	Copying and Misbehaviour in the examination hall	Cancellation of all papers of that semester and debarring the candidate from appearing for the next semester examination.

7	Insertion of answer sheets which were previously stolen and written	Cancellation of all papers of that semester and debarring the candidate from appearing for the next semester examination.
8	Impersonation in the examination	Cancellation of all papers of that semester and recommending dismissal from the college.