B. Sc. Statistics

Syllabus

AFFILIATED COLLEGES

Program Code:22B

2020 – 2021 onwards

BHARATHIAR UNIVERSITY

(A State University, Accredited with "A" Grade by NAAC,
Ranked 13th among Indian Universities by MHRD-NIRF,
World Ranking: Times -801-1000,Shanghai -901-1000, URAP - 982)

Coimbatore - 641 046, Tamil Nadu, India

Program Educational Objectives (PEOs)	
On successful completion of the **B**. **Sc., Statistics** program, the graduates will be able to:	
PEO1	Get employment in government, public and private sectors.
PEO2	Perform data analysis and make interpretations with the knowledge attained during the course of study
PEO3	Gain knowledge to pursue higher studies in Statistics
PEO4	Use programming languages for developing codes for statistical computation
PEO5	Serve as biostatistician, statistical investigator, statistical assistant with knowledge in statistics

Program Specific Outcomes (PSOs)	
On successful completion of B. Sc. Statistics program, the students are expected to	
PSO1	Realize the importance of statistics
PSO2	Identify the areas of applications of statistics
PSO3	Write computer programs for statistical computation
PSO4	Apply statistical software for data analysis
PSO5	Understand the limitations of statistical methods
PSO6	Analyze statistical data and make interpretations

Program Outcomes (POs)	
On successful completion of the B. Sc. Statistics program, students will be able to	
PO1	Apply the theoretical knowledge in statistics to real life situations
PO2	Apply the concepts, principles and methods of statistics to various fields of study
PO3	Adopt statistical methods for data analysis
PO4	Compute statistical measures using software and programs
PO5	Get opportunities for job placements in various sectors
PO6	Acquire skills to write competitive examinations
PO7	Move for higher level learning
PO8	Perform data analysis using statistical methods
PO9	Identify diversified areas of applications of statistical theory
PO10	Understand the importance and value of statistical principles

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Branch II: B. Sc. STATISTICS (CBCS PATTERN)

(For the students admitted from the academic year **2020-2021** and onwards)

Scheme of Examination

Part	Title of the Course	Hours/ Week	Examination				Credits
			Duration in Hours	Maximum Marks			
				CIA	CEE	Total	
	Semester I						
I	Language - I	6	3	25	75	100	4
II	English - I	6	3	25	75	100	4
III	Core Paper I - Descriptive Statistics - I	3	3	25	75	100	4
III	Core Paper II - Descriptive Statistics - II	4	3	25	75	100	4
III	Core Practical - I (Using MS Excel)	2	-	-	-	-	-
III	Allied A: Paper I - Mathematics for Statistics - I	7	3	25	75	100	4
IV	Environmental Studies*	2	3	-	50		2
	Total	**30**		**125**	**375@**	**500**	**22**
	Semester II						
I	Language – II	6	3	25	75	100	4
II	English – II	6	3	25	75	100	4
III	Core Paper III - Applied Statistics	7	3	25	75	100	4
III	Core Practical - I (Using MS Excel)	2	3	30	45	75	3
III	Allied A: Paper II Mathematics for Statistics - II	7	3	25	75	100	4
IV	Value Education – Human Rights*	2	3	-	50		2
	Total	**30**		**130**	**345@**	**475**	**21**
	Semester III						
I	Language – III	6	3	25	75	100	4
II	English – III	6	3	25	75	100	4
III	Core Paper IV- Demographic Methods	3	3	25	75	100	4
III	Core Paper V- Probability Distribution-I	3	3	25	75	100	4
III	Allied B: Paper I – Computer Programming for Statistical Analysis - I (C Programming)	5	3	20	55	75	3
III	Allied Practical (C & C++ Programming)	2	-	-	-	-	-
IV	Skill based Subject: Actuarial Statistics - I	3	3	20	55	75	3
IV	Tamil** / Advanced Tamil* (OR) Non-major elective - I (Yoga for Human Excellence)* / Women's Rights*	2	3	50	50	100	2
	Total	**30**		**190**	**460**	**650**	**24**

	Semester IV						
I	Language – IV	6	3	25	75	100	4
II	English – IV	6	3	25	75	100	4
III	Core Paper VI Probability Distribution - II	4	3	25	75	100	4
III	Core Practical II (Using Scientific Calculator)	2	3	30	45	75	3
III	Allied B: Paper II - Computer Programming for Statistical Analysis-II (Object Oriented Programming with C++)	5	3	20	55	75	3
III	Allied Practical (C & C++ programming)	2	3	20	30	50	2
IV	Skill based Subject 2: Actuarial Statistics - II	3	3	20	55	75	3
IV	Tamil**/Advanced Tamil* (OR) Non-major elective -II (General Awareness*)	2	3	50	50	100	2
	Total	**30**		**215**	**460**	**675**	**25**
	Semester V						
III	Core Paper VII - Statistical Inference - I	5	3	25	75	100	4
III	Core Paper VIII - Basic Sampling Theory	5	3	25	75	100	4
III	Core Paper IX - Design of Experiments	5	3	25	75	100	4
III	Core Practical - III (Using SPSS)	2	3	-	-	-	-
III	Core Paper X - Numerical Mathematics	5	3	25	75	100	4
III	Elective I	5	3	20	55	75	3
IV	Skill based Subject 3: Mathematical Economics - I	3	3	20	55	75	3
	Total	**30**		**140**	**410**	**550**	**22**
	Semester VI						
III	Core Paper XI - Statistical Inference - II	5	3	25	75	100	4
III	Core Paper XII - Statistical Quality Control	5	3	25	75	100	4
III	Core Practical - III (Using SPSS)	2	3	30	45	75	3
III	Elective II	5	3	20	55	75	3
III	Elective III	5	3	20	55	75	3
III	Core Practical - IV (Using Scientific Calculator)	5	3	40	60	100	4
IV	Skill Based Subject 4 Mathematical Economics - II	3	3	20	55	75	3
V	Extension Activities**	-	-	50	-	50	2
	Total	**30**		**230**	**420**	**650**	**26**
	Grand Total	**180**		**1030**	**2470**	**3500**	**140**

* No Continuous Internal Assessment (CIA). Only University Examinations.
** No University Examinations. Only Continuous Internal Assessment (CIA).
@ Excluding the marks of Part IV

First
Semester

Course Code		TITLE OF THE COURSE	L	T	P	C
Core I		Descriptive Statistics –I	3	1	-	4
Pre-requisite		Basic level of mathematical computation	Syllabus Version		2020-21	

Course Objectives:

The main objectives of this course are to:

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

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Understand the scope and necessity of Statistics.	K1,K2
2	Tabulate and represent the data in diagrams and graphs.	K2, K3
3	Apply the formula and calculate descriptive measures of statistics.	K2, K3,K4
4	Analyze the nature of data and interpret the measures	K2, K3,K4
5	Analyze the data and predict the future values using curve fitting.	K4,K5

K1 - Remember; **K2** - Undestand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6**– Create

Unit:1	Nature and Scope of Statistics	9 hours

Origin, scope, limitations and misuse of Statistics. Data- Types- Primary and Secondary Data- Methods of data Collection-Classification- Tabulation of data. Measurement of Scales. Diagrammatic representation of data: One dimensional and Two dimensional diagrams – Graphic representation: Line diagram, Frequency polygon, Frequency curve, Histogram and Ogive curves.

Unit:2	Measures of Central Tendency and Dispersion	9 hours

Measures of Central Tendency: Mean, Median, Mode, Geometric Mean and Harmonic Mean- Properties with Merits and Demerits- Empirical Relation between means. Partition values: Quartiles, Deciles and Percentiles. Measures of Dispersion: Absolute and Relative Measures Range, Mean deviation, Quartile deviation and Standard deviation – Coefficient of Variation.

Unit:3	Measures of Skewness and Kurtosis	9 hours

Moments - Measures of Skewness - Pearson's and Bowley's Coefficient of Skewness, Coefficient of Skewness based on moments – Kurtosis and its significance.

Unit:4	Curve Fitting	9 hours

Curve Fitting: Principle of least squares, fitting of the curves of the form y = a+ bx,

$y = a + bx + cx^2$ and curves transformable to the above form.		
Unit:5	**Case Study and Problems**	**9 hours**
Case study and Problems relating to all the above units.		
Unit:6	**Contemporary Issues**	**2 hours**
Expert lectures, Online seminars– Webinars		
	Total Lecture hours	**47 hours**

Text Book(s)	
1	Gupta, S.C., and Kappor, V. K. (2020). Fundamentals of Mathematical Statistics, 12th Edition, Sultan Chand & Sons (Publisher), New Delhi, India
2	Goon, A.M., Gupta, M. K., Dasgupta, B. (2016): Fundamentals of Statistics, Vol. I, World Press, Kolkata, India
3	Agarwal, B. L. (2006). Basic Statistics, New Age International Private Limited, New Delhi, India.

Reference Books	
1	Holcomb, Z. C. (2017). Fundamentals of Descriptive Statistics, Routledge, New York, US.

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://nptel.ac.in/courses/111/104/111104120/
2	https://www.iiserpune.ac.in/~bhasbapat/phy221_files/curvefitting.pdf

Course Designed By: Dr. Vasanthamani .P

Mapping with Programme Outcomes										
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	S	S	M	M	S	M	M	S	M	M
CO2	S	S	M	S	S	M	M	S	M	M
CO3	S	S	M	M	S	M	S	S	M	M
CO4	S	S	S	M	S	M	M	S	M	M
CO5	S	S	S	M	M	S	M	M	S	S

*S-Strong; M-Medium; L-Low

Course code		TITLE OF THE COURSE	L	T	P	C
Core II		Descriptive Statistics – II	3	1	-	4
Pre-requisite		Basic level on mathematical computation	Syllabus Version		2020-21	

Course Objectives:

The main objectives of this course are to:

1. Understand the relationship between two variables.
2. Know the concept of association of attributes and methods.
3. Understand theoretical probability and its concepts.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Measure and interpret the degree of relationship between variables.	K1, K2, K3
2	Estimate the average relationship using regression.	K3, K4, K5
3	Interpret the association of attributes applying different methods.	K3, K4, K5
4	Understand the concepts of probability and relate to real life situations	K1, K2
5	Apply the theorems in practical problems with conditional probability	K3, K4

K1 - Remember; **K2** - Undestand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6**– Create

Unit:1	Correlation and Regression	9 hours

Linear Correlation-Scatter diagram, Pearson's Coefficient of Correlation, Correlation in bivariate frequency table, Rank Correlation, Coefficient of Concurrent Deviation. Properties and its derivations. Regression – Types – Line of Regression and its derivation - Regression coefficients – Properties of regression coefficients – Comparison of correlation and regression.

Unit:2	Association of Attributes	9 hours

Association of attributes: Relation between class frequencies, consistency of data, independence of attributes, criterion of independence. Association of attributes: Yule's coefficient of association, Yule'coefficient of colligation.

Unit:3	Basics of Probability	9 hours

Probability: Sample space-Concepts of events- Algebraic operations on events-Definitions of probability.

Unit:4	Properties of Probability	9 hours

Generalized addition and compound Theorems of probability-independent events – Conditional probability, Inverse probability – Baye's Theorem.

Unit:5	**Case Study and Problems**	**9 hours**
Case study and problems related to all the above units		
Unit:6	**Contemporary Issues**	**2 hours**
Expert lectures, online seminars– webinars		
	Total Lecture hours	**47 hours**

Text Book(s)	
1	Gupta, S.C., and Kappor, V. K. (2020). Fundamentals of Mathematical Statistics, 12th Edition, Sultan Chand & Sons (Publisher), New Delhi, India.
2	Gupta, S. P. (2011). Statistical Methods, 4th Edition, Sultan Chand & Sons (Publisher), New Delhi, India.
3	Agarwal, B. L. (2006). Basic Statistics, New Age International Private Limited, New Delhi, India.

Reference Books	
1	Holcomb, Z. C. (2017). Fundamentals of Descriptive Statistics, Routledge, New York, US.

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://nptel.ac.in/courses/111/106/111106112/
2	https://nptel.ac.in/courses/111/105/111105090/
3	https://nptel.ac.in/courses/111/105/111105042/

Course Designed By: Dr. Sampath Kumar .R

Mapping with Programme Outcomes										
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	S	S	M	M	S	M	M	M	M	S
CO3	S	S	M	S	S	M	M	M	M	S
CO3	S	S	M	M	S	M	S	S	M	S
CO4	S	S	S	M	S	M	M	M	M	S
CO5	S	S	S	M	M	S	M	M	S	S

*S-Strong; M-Medium; L-Low

Second Semester

Course code		TITLE OF THE COURSE	L	T	P	C
Core III		Applied Statistics	3	1	-	4
Pre-requisite		Basic level on statistical computation	Syllabus Version		2020-21	

Course Objectives:

The main objectives of this course are to:

1. be acquainted with the knowledge of time series analysis.
2. understand the significance of index numbers and its types.
3. describe demographic data and vital statistics measures.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Identify the components of time series and the method of measuring trend.	K1, K2
2	Apply the different measures of variations to forecast the data.	K2, K3, K4
3	Construct index numbers, evaluate the cost of living index and interpret.	K2, K3
4	Understand the vital statistics and its importance in the civic society.	K1, K2
5	Evaluate and interpret the fertility measures.	K3, K4, K5

K1 - Remember; **K2** - Undestand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** – Create

Unit:1	Time Series: Components, Models, Measuring Trend	9 hours

Concept – components of time series –additive and multiplicative models-Resolving components of a time series-measuring trend: Graphic, semi-averages, moving average and principle of least squares methods.

Unit:2	Time Series: Measuring Seasonal and Cyclic Variations	9 hours

Seasonal variation- measuring seasonal variation: method of simple averages, ratio to trend method, ratio to moving average method and link relative method- Cyclical and Random fluctuations- variate difference method.

Unit:3	Index Numbers	9 hours

Index numbers and their definitions - construction and uses of fixed and chain based index numbers-simple and weighted index numbers - Laspeyre's, Paache's, Fisher's, and Marshall-edge-worth index numbers – optimum tests for index numbers-Cost of living index numbers.

Unit:4	Demographic Methods	9 hours

Demography – definition-sources of demographic data: vital registration-population census - population register-demographic surveys-population data as aid to social, economic and healthy

planning - process of Indian Civil registration and census.		
Unit:5	**Demographic Methods**	**9 hours**
Fertility measurements: Fertility as a component of population change - Crude Birth Rate (CBR)- General, Specific and Total Fertility Rates(GFR, ASFR,TFR) - Gross and Net Reproduction Rates (GRR & NRR) the relationships and interpretation.		
Unit:6	**Contemporary Issues**	**2 hours**
Expert lectures, online seminars – webinars		
	Total Lecture hours	**47 hours**

Text Book(s)	
1	Gupta, S.C., and Kappor, V. K. (2019). Fundamentals of Applied Statistics, Fourth Edition, Sultan Chand & Sons (Publisher), New Delhi, India
2	Goon, A.M., Gupta, M. K., Dasgupta, B. (2016): Fundamentals of Statistics, Vol. II, World Press, Kolkata, India
3	Agarwal, B. L. (2006). Basic Statistics, New Age International Private Limited, New Delhi, India.
Reference Books	
1	Parimal, M. (1999), Applied Statistics, 2nd Edition, Books & Applied Ltd., Kolkata, India
Related O2nd Editionnline Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://www.stat.berkeley.edu/~bartlett/courses/153-fall2010/lectures/1.pdf
2	http://www.gdcboysang.ac.in/About/droid/uploads/EconomicsPart4.pdf
3	http://ocw.jhsph.edu/courses/demographicmethods/PDFs/idm-sec1.pdf
Course Designed By: Dr. Uma .G	

Mapping with Programme Outcomes										
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	S	S	M	M	S	M	M	S	M	S
CO3	S	S	M	S	S	M	M	S	S	S
CO3	S	S	M	M	S	M	S	S	M	S
CO4	S	S	S	M	S	M	M	S	M	S
CO5	S	S	S	M	M	S	M	M	M	S

*S-Strong; M-Medium; L-Low

Third
Semester

Course code		TITLE OF THE COURSE	L	T	P	C
Core IV		Demographic Methods	3	1	-	
Pre-requisite		Basic knowledge of population studies	Syllabus Version		2020-21	

Course Objectives:

The main objectives of this course are to::

1. Understand the meaning of demography
2. Learn to compute measures of mortality
3. Compute life tables and learn population projection techniques.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	know mortality measurements.	K1,K2
2	understand the description and construction of life tables.	K2
3	analyze migration factors.	K4, K3
4	know population estimates and projection.	K3,K4
5	know different methods of population estimates.	K5,K6

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6**– Create

Unit:1	Measures of Mortality	9 hours

Crude death rate- specific death rates-standardized death rates-direct and indirect methods.

Unit:2	Mortality Rates	9 hours

Comparative mortality index-infant mortality rate-maternal mortality rate- cause- of- death rate-case fatality rate-force of mortality- graduation of mortality rates–Gompertz and Makeham's laws.

Unit:3	Life Tables and their Construction	9 hours

Assumptions, description and construction of various columns of a life table and their relationships- uses of a life table- age pyramid.

Unit:4	Abridged Life Tables and Migration	9 hours

Construction of an abridged life table –Reid and Merrell method - Greville's method –migration-factors effecting migration-gross and net migration rates.

Unit:5	Population Projection	9 hours

Population estimates and projection –arithmetic, geometric and exponential growth rates- logistics curves-Pearl and Reed method –method of Rhodes-Basic ideas of stationary and stable population.

Unit:6	**Contemporary Issues**	**2 hours**
Expert lectures, Online seminars– Webinars		
	Total Lecture hours	**47 hours**

Text Book(s)	
1	Gupta, S.C., and Kappor, V. K. (2019). Fundamentals of Applied Statistics, Fourth Edition, Sultan Chand & Sons (Publisher), New Delhi, India.
2	Misra, B. D. (1995). An Introduction to the Study of PopulationSouth Asian Publishers, New Delhi
3	Hansraj. (1978). Fundamentals of Demography: Population Studies (With Special Reference to India), Surjeet Publications, New Delhi, India.
4	Parimal, M. (1999), Applied Statistics, 2nd Edition, Books & Applied Ltd., Kolkata, India
Reference Books	
1	Agarwala, S. N. (1972). India's Population Problems, Tata McGraw Hill Publishing Company, India.
2	Goon, A.M., Gupta, M. K., Dasgupta, B. (2016): Fundamentals of Statistics, Vol. II, World Press, Kolkata, India
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://onlinecourses.nptel.ac.in/noc19_hs39/preview
2	https://nptel.ac.in/courses/109/104/109104150/
3	http://ocw.jhsph.edu/courses/demographicmethods/lectureNotes.cfm
Course Designed By: T. Santhi.	

Mapping with Programme Outcomes										
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	S	S	M	M	S	M	M	M	M	M
CO2	S	S	M	S	S	M	M	S	M	S
CO3	S	S	M	M	S	M	S	M	S	M
CO4	S	S	S	M	S	M	M	S	M	S
CO5	S	S	S	M	M	S	M	S	M	M

*S-Strong; M-Medium; L-Low

Course code		TITLE OF THE COURSE	L	T	P	C
Core V		Probability and Distributions – I	3	1	-	4
Pre-requisite		Fundamentals of probability concepts	Syllabus Version		2020-21	

Course Objectives:

The main objectives of this course are to:
1. Introduce the concept of random variable and its types.
2. Define generating functions and characteristic functions
3. Define law of large numbers and central limit theorem

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Understand the concept of random variable and classification	K1,K2
2	Understand the probability mass functions and probability density function	K2, K3
3	Know the probability distribution functions and its properties	K2, K3,K4
4	Know the mathematical expectation,variance and moment generating function and characteristic function and their properties.	K2, K3,K4
5	Analyze the data and predict the future values using curve fitting.	K4,K5

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6**– Create

Unit:1	Random Variables	9 hours

Random variables –discrete and continuous random variables –distribution function-properties-probability mass function and probability density function –various statistical measures of continuous probability distribution.

Unit:2	Marginal and Conditional Distributions	9 hours

Joint, marginal and conditional distribution functions and density functions- independence of random variables –Transformation of variables (one and two dimensional-concepts only).

Unit:3	Mathematical Expectations and Properties	9 hours

Mathematical expectation-properties - addition and multiplication theorems - Cauchy-Schwarz inequality, conditional expectation and conditional variance.

Unit:4	Generating Functions and Characteristic Functions	9 hours

Moment generating function, cumulant generating function, characteristic function and their properties.

Unit:5	Law of Large Numbers and Central Limit Theorem	9 hours

Tchebychev's inequality, convergence in probability, weak law of large numbers and central limit theorem.		
Unit:6	**Contemporary Issues**	**2 hours**
Expert lectures, Online seminars– Webinars		
	Total Lecture hours	**47 hours**

Text Book(s)	
1	Gupta, S.C., and Kappor, V. K. (2020). Fundamentals of Mathematical Statistics, 12th Edition, Sultan Chand & Sons (Publisher), New Delhi, India
2	Hogg, R., McKean, J., and Craig, A. (2012). Introduction to Mathematical Statistics, 7th Edition, Pearson, New York, US.
Reference Books	
1	Freund, J. E. (2013). Mathematical Statistics with Applications, Pearson Education India, New Delhi
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://nptel.ac.in/courses/111/102/111102111/
2	https://nptel.ac.in/courses/111/104/111104079/
Course Designed By:T. Santhi	

Mapping with Programme Outcomes										
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	S	S	M	M	S	M	M	M	M	M
CO2	S	S	M	S	S	M	M	S	M	S
CO3	S	S	M	M	S	M	S	M	S	M
CO4	S	S	S	M	S	M	M	S	M	S
CO5	S	S	S	M	M	S	M	S	M	M

*S-Strong; M-Medium; L-Low

Fourth Semester

Course code		TITLE OF THE COURSE	L	T	P	C
Core VI		Probability and Distributions – II	3	1	-	4
Pre-requisite		Revision of basic concepts studied in Core Paper V	Syllabus Version		2020-21	

Course Objectives:

The main objectives of this course are to:

1. Introduce various types of probability distributions
2. Study the properties of probability distributions
3..Explore the applications of probability distributions.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Know the definition and properties of Binomial, Poisson and Negative Binomial distributions.	K1,K2
2	Understand the moments, M.G.F. of hyper-geometric distributions and Multinomial distributions.	K2, K3
3	Know the normal distribution and Bivariate normal distribution and mean, median, mode and M.G.F and cumulants, mean deviation, characteristic function of normal distribution.	K2, K3,K4
4	Know Gamma and Betta distributions of I and II kind.	K2, K3,K4
5	Understand functions of normal variable leading to‘t’ and ‘F’ distribution and interrelation.	K4,K5

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6**– Create

Unit:1	**Discrete Probability Distributions and their Properties**	**9 hours**

Binomial, Poisson and Negative-Binomial distributions – Moments, m.g.f, cumulants, additive property, recurrence relation for the probabilities- simple problems.

Unit:2	**Discrete Probability Distributions and their Properties**	**9 hours**

Geometric distribution – moments, m.g.f – Hyper-geometric distribution- mean, variance, m.g.f, Binomial as a limiting form of Hyper- geometric distribution – Multinomial distribution – moments

Unit:3	**Continuous Probability Distributions and their Properties**	**9 hours**

Normal distribution – limiting form of Binomial distribution, properties, median, mode, moments, m.g.f, cumulants, mean deviation, area property, simple problems – Rectangular distribution- moments, m.g.f. characteristic function, mean deviation – Bivariate normal distribution.

Unit:4	**Continuous Probability Distributions and their Properties**	**9 hours**

Gamma, Beta distributions of me kind and II kind – constants – Exponential distribution –additive property.

Unit:5	**Exact Sampling Distributions**	**9 hours**
Functions of normal random variable leading to x^2, t and F distributions – inter relationship between the distributions and their properties. Random variables –discrete and continuous random variables –distribution function-properties- probability mass function and probability density function –various statistical measures of continuous probability distribution.		
Unit:6	**Contemporary Issues**	**2 hours**
Expert lectures, Online seminars– Webinars		
	Total Lecture hours	**47 hours**

Text Book(s)	
1	Gupta, S.C., and Kappor, V. K. (2020). Fundamentals of Mathematical Statistics, 12th Edition, Sultan Chand & Sons (Publisher), New Delhi, India
2	Hogg, R., McKean, J., and Craig, A. (2012). Introduction to Mathematical Statistics, 7th Edition, Pearson, New York, US.
Reference Books	
1	Freund, J. E. (2013). Mathematical Statistics with Applications, Pearson Education India, New Delhi
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://nptel.ac.in/courses/111/104/111104032/
2	https://nptel.ac.in/courses/111/105/111105041/
Course Designed By: T.Santhi	

Mapping with Programme Outcomes										
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	S	S	M	M	S	M	M	M	M	M
CO2	S	S	M	S	S	M	M	S	M	S
CO3	S	S	M	M	S	M	S	M	S	M
CO4	S	S	S	M	S	M	M	S	M	S
CO5	S	S	S	M	M	S	M	S	M	M

*S-Strong; M-Medium; L-Low

Fifth Semester

Course code		TITLE OF THE COURSE	L	T	P	C
Core VII		Statistical Inference – I	3	1	-	4
Pre-requisite		Have the knowledge of what is parameter,sample , statistics, estimation, estimator.	Syllabus Version		2020-21	

Course Objectives:

The main objectives of this course are to:

1. Introduce concept of estimation
2. Learn properties of estimators
3. Learn to distinguish point estimation and interval estimation

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Understand the concept of Statistical inference, parametric estimation, derivation of standard error of mean, variance, Etc., also concept of ordered statistics.	K1,K2
2	Understand the point estimation, estimator and its properties.	K2, K3
3	Know the different method of estimation.	K2, K3,K4
4	Know the interval estimation, Confidence intervals- using Cramer – Rao inequality-Partial and multiple correlation and regression coefficients	K2, K3,K4
5	Solving problems in interval estimation, multiple and partial correlation co-efficient.	K4,K5

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6**– Create

Unit:1	Basic Notions of Statistical Inference	9 hours

Concept of Statistical Inference- Parametric estimation- Sampling distribution - Standard Error. Derivation of Standard Error of mean, variance, proportion, difference between means variances and Proportions-concept of ordered statistics.

Unit:2	Point Estimation and Properties of Point Estimators	9 hours

Point Estimation: Estimator, properties of point estimator – unbiasedness, consistency, Crammer Rao inequality – efficiency – asymptotic efficiency and sufficiency of the estimator – Rao Blackwell theorem.

Unit:3	Methods of Estimation	9 hours

Methods of point estimation: method of maximum likelihood, method of minimum chi-square and method of moments - properties of estimators obtained by these methods (Without proof).

Unit:4	Interval Estimation	9 hours

Interval Estimation: Fiducial limits-derivation of confidence intervals based on Normal,'t' x^2 and

F distributions. Confidence intervals- using Cramer – Rao inequality-Partial and multiple correlation and regression coefficients – Multiple linear regression lines.		
Unit:5	**Interval Estimation – Problems**	**9 hours**
Numerical problems in interval estimation, multiple and partial correlation and regression. –simple problems only		
Unit:6	**Contemporary Issues**	**2 hours**
Expert lectures, Online seminars– Webinars		
	Total Lecture hours	**47 hours**

Text Book(s)	
1	Hoel, P. G. (1984). Introduction to Mathematical Statistics, 5th Edition, Wiley, New York.
2	Gupta, S.C., and Kappor, V. K. (2020). Fundamentals of Mathematical Statistics, 12th Edition, Sultan Chand & Sons (Publisher), New Delhi, India
3	Hogg, R., McKean, J., and Craig, A. (2012). Introduction to Mathematical Statistics, 7th Edition, Pearson, New York, US.
Reference Books	
1	Brunk, H. D. (1965). An Introduction to Mathematical Statistics, Blaisdell Publishing Company, US
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://nptel.ac.in/courses/111/102/111102112/
2	https://www.digimat.in/nptel/courses/video/111105124/L01.html
Course Designed By: T.Santhi	

Mapping with Programme Outcomes										
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	S	S	M	M	S	M	M	M	M	M
CO2	S	S	M	S	S	M	M	S	M	S
CO3	S	S	M	M	S	M	S	M	S	M
CO4	S	S	S	M	S	M	M	S	M	S
CO5	S	S	S	M	M	S	M	S	M	M

*S-Strong; M-Medium; L-Low

Course code		TITLE OF THE COURSE	L	T	P	C
Core VIII		Basic Sampling Theory	3	1	-	4
Pre-requisite		Have the knowledge of origin of sampling.	Syllabus Version		2020-21	

Course Objectives:

The main objectives of this course are to:

1. Introduce the concept of census and sample surveys.
2. Learn various methods of sampling
3. Study the properties of estimators under different sampling methods.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Understand simple sampling with and without replacement, estimation of sample size.	K1,K2
2	Understand stratified sampling in detail.	K2, K3
3	Know the systematic sampling and finding unbiased estimates of the mean and variants.	K2, K3,K4
4	Understand cluster sampling in detail.	K2, K3,K4
5	Understand design, organization and execution of sample surveys.	K4,K5

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6**– Create

Unit:1	Simple Random Sampling	9 hours

Sampling from a finite population –Random sampling –simple sampling with and without replacement –unbiased estimates of the mean and the variance of the population and of the variance of the estimator of the mean - Estimation of the sample size.

Unit:2	Stratified Random Sampling	9 hours

Stratified sampling – proportional and optimum allocation with regard to stratified random sampling-unbiased estimates of the mean and the variance of the population and of the variance of the estimator of the mean.

Unit:3	Systematic Sampling	9 hours

Systematic sampling –Unbiased estimates of the mean and the variance of the population and of the variance of the estimator of the mean.

Unit:4	Cluster and Two-stage Sampling	9 hours

Cluster and two stage sampling –unbiased estimates of the mean and variance of the population and of the variance of the estimator of the mean.

Unit:5	**Sample Survey and Errors in Sample Survey**	**9 hours**
Design, organization and execution of sample surveys –sampling and non-sampling errors and methods to deal with sampling errors.		
Unit:6	**Contemporary Issues**	**2 hours**
Expert lectures, Online seminars– Webinars		
	Total Lecture hours	**47 hours**

Text Book(s)	
1	Cochran, W.G. (1977). Sampling Techniques, Third Edition, John Wiley & Sons, NY.
2	Des Raj (1978), Sampling Theory, Tata-McGraw Hill, New Delhi.
3	Singh D., and Chowdhary, F. S. (2018). Theory and Analysis of Sample Survey Design, New Age International Private Ltd., New Delhi.
4	Gupta, S.C., and Kappor, V. K. (2019). Fundamentals of Applied Statistics, Fourth Edition, Sultan Chand & Sons (Publisher), New Delhi, India.

Reference Books	
1	Murthy, M. N. (1967). Sampling Theory and Methods, Statistical Publishing Society, Calcutta.
2	Sukhatme, P. V., and Sukhatme, B. V. (1970). Sampling Theory of Surveys with Applications, Asia Publishing House, New Delhi.

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://nptel.ac.in/courses/111/104/111104073/
2	https://nptel.ac.in/content/storage2/courses/111104073/Module14/Lecture42.pdf
3	https://www.mooc-list.com/tags/sampling-methods

Course Designed By: T.Santhi

Mapping with Programme Outcomes										
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	S	S	M	M	S	M	M	M	M	M
CO2	S	S	M	S	S	M	M	S	M	S
CO3	S	S	M	M	S	M	S	M	S	M
CO4	S	S	S	M	S	M	M	S	M	S
CO5	S	S	S	M	M	S	M	S	M	M

*S-Strong; M-Medium; L-Low

Course code		TITLE OF THE COURSE	L	T	P	C
Core IX		Design of Experiments	3	1	-	4
Pre-requisite		Basic knowledge of field experiments and concept of variance	Syllabus Version		2020-21	

Course Objectives:

The main objectives of this course are to:

1. Impart the knowledge of performing analysis of variance.
2. Propose methods of performing analysis of variance under different types of experimental designs
3. Learn how to estimate missing observations, compare the efficiencies of various designs and the concept of ANACOVA.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Understand the linear design models, analysis of variance.	K1,K2
2	Understand fundamentals of experimentation.	K2, K3
3	Analyze the different experiments CRD, RBD, and LSD.	K2, K3,K4
4	Understand ANCOVA with one concomitant variable to CRD and RBD.	K2, K3,K4
5	Understand factorial designs - 2^2,$2^3$and 3^2 factorial designs.	K4,K5,K6

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6**– Create

Unit:1	Analysis of Variance	9 hours

Linear design models-Least Square estimates of parameters and variance of estimates –Analysis of variance: One way and two way classifications.

Unit:2	Principles of Designs	9 hours

Fundamentals of experimentation: Plot and pen techniques –determination of shape and size of plots – Uniformity trials –Replication, randomization and local control techniques

Unit:3	Basic Designs	9 hours

Analysis of different experiments: CRD, RBD and LSD and their efficiencies

Unit:4	Analysis of Covariance	9 hours

Missing plot techniques (atmost two values)-Analysis of covariance (ANCOVA) with one concomitant variable to CRD and RBD.

Unit:5	Factorial Designs	9 hours

Factorial designs -2^2,$2^3$and 3^2 factorial designs with and without confounding.

Unit:6	**Contemporary Issues**	**2 hours**
Expert lectures, Online seminars– Webinars		
	Total Lecture hours	**47 hours**

Text Book(s)	
1	Gupta, S.C., and Kappor, V. K. (2019). Fundamentals of Applied Statistics, Fourth Edition, Sultan Chand & Sons (Publisher), New Delhi, India.
2	Cochran, W.G. and Cox, G.M. (1992). Experimental Designs, Second Edition, John Wiley & Sons, New York.
3	Federer, W. T. (1967). Experimental Design: Theory and Application, Indian Edition, Oxford and IBH Publishing Co., New Delhi.
Reference Books	
1	Montgomory, D.C. (2012). Design and Analysis of Experiments, Eighth Edition, John Wiley & Sons, NY.
2	Parimal, M. (1999), Applied Statistics, 2nd Edition, Books & Applied Ltd., Kolkata, India
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://nptel.ac.in/courses/111/104/111104075/
2	https://nptel.ac.in/courses/110/105/110105087/
Course Designed By:T.Santhi	

Mapping with Programme Outcomes										
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	S	S	M	M	S	M	M	M	M	M
CO2	S	S	M	S	S	M	M	S	M	S
CO3	S	S	M	M	S	M	S	M	S	M
CO4	S	S	S	M	S	M	M	S	M	S
CO5	S	S	S	M	M	S	M	S	M	M

*S-Strong; M-Medium; L-Low

Course code		TITLE OF THE COURSE	L	T	P	C
Core X		Numerical Mathematics	3	1	-	4
Pre-requisite		Basic Mathematical and Computational Skill	Syllabus Version		2020-21	

Course Objectives

The main objectives of this course are to:

1. Learn numerical methods of interpolation
2. Understand the methods of numerical differentiation
3. Apply methods of numerical integration for evaluating the integrals

Expected Course Outcomes

On the successful completion of the course, student will be able to:

1	Understand finite differences, interpolation for equal intervals using Newton – Gregory forward and backward interpolation formulae.	K1, K2
2	Understand central difference interpolate formulae, Gauss forward and backward formulae.	K2, K3
3	Know the interpolation for unequal intervals by Newton's divided difference formula.	K2, K3,K4
4	Understand numerical differentiation and integration – Trapezoidal, Simpson's $1/3^{rd}$ and $3/8^{th}$ rules.	K2, K3,K4
5	Understand iterative method of Eigen values.	K4, K5

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6**– Create

Unit:1	Finite Difference and Interpolation for Equal Intervals	9 hours

Finite differences – difference of a polynomial, factorial polynomial- Interpolation for equal intervals – Newton-Gregory forward and backward interpolation formulae.

Unit:2	Central Differences and Interpolation	9 hours

Central difference interpolation formulae, Gauss forward and backward formulae, Stirling's, Bessel's and Laplace – Everett's formulae, summation of series.

Unit:3	Interpolation for Unequal Intervals	9 hours

Interpolation for unequal intervals: Newton's divided difference formula and Lagrange's formulae, Inverse interpolation.

Unit:4	Numerical Differentiation and Integration	9 hours

Numerical differentiation and integration- Numerical differentiation up to second order, maxima and minima- Numerical integration : Trapezoidal, Simpson's 1/3 rd and 3/8th rules

Unit:5	Solution for Non-linear Equations	9 hours

Iterative method of Eigen values – Power method, Jacobi method, Solution of system of Non-Linear equations – Newton – Rapson method.		
Unit:6	**Contemporary Issues**	**2 hours**
Expert lectures, Online seminars– Webinars		
	Total Lecture hours	**47 hours**
Text Book(s)		
1	Sastry, S. S. (2012). Introductory Methods of Numerical Analysis, 5th Edition, PHI Learning Private Limited, New Delhi, India.	
2	Kandasamy, P., Thilagavathy, K., and Gunavathy, K. (2013). Numerical Methods, S. Chand & Co, New Delhi, India.	
Reference Books		
1	Jain, M. K., Iyengar, S. R. K., and Jain, R. K. (2020). Numerical Methods, New Age International Private Limited, New Delhi, India.	
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]		
1	https://nptel.ac.in/courses/111/107/111107105/	
2	https://nptel.ac.in/courses/111/106/111106101/	
3	https://nptel.ac.in/courses/111/101/111101003/	
Course Designed By: T.Santhi.		

Mapping with Programme Outcomes										
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	S	S	M	M	S	M	M	M	M	M
CO2	S	S	M	S	S	M	M	S	M	S
CO3	S	S	M	M	S	M	S	M	S	M
CO4	S	S	S	M	S	M	M	S	M	S
CO5	S	S	S	M	M	S	M	S	M	M

*S-Strong; M-Medium; L-Low

Sixth Semester

Course code		TITLE OF THE COURSE	L	T	P	C
Core XI		Statistical Inference - II	3	1	-	4
Pre-requisite		Basics of probability, distributions and sampling	Syllabus Version		2020-21	

Course Objectives:

The main objectives of this course are to:

1. Gain knowledge on the methods of testing statistical hypothesis.
2. Understand the meaning and applications of tests of significance

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Understand testing of statistical hypothesis.	K1,K2
2	Understand the concept of most powerful test and uniformly most powerful test based on normal, 't' and 'F' distributions.	K2, K3
3	Understand test of significance, tests based on normal, 't' and 'F' distributions.	K2, K3,K4
4	Understand Contingency table, goodness of fitness.	K2, K3, K4, K6
5	Understand free and non-parametric tests, Mann-Whitney tests.	K4,K5

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6**– Create

Unit:1	Basic Notions of Testing Statistical Hypothesis	9 hours

Testing of Statistical hypothesis: Statistical hypothesis -simple and composite hypothesis, null and alternative hypotheses-sample and parameter space –two types of errors – critical region-power a test –Neyman- Pearson Lemma –simple applications

Unit:2	Most Powerful and Uniformly Most Powerful Tests	9 hours

Most powerful tests-uniformly most powerful and unbiased tests based on Normal, t, and x^2 and F distributions - likelihood ratio criterion –definition and simple applications

Unit:3	Test of Significance	9 hours

Test of significance –Asymptotic and exact tests based on Normal, t, and x^2 and F distributions with regard to mean, proportion, variance, Standard deviation, coefficient of correlation, regression coefficients, partial and multiple correlation coefficients-Concept of observed significance level.

Unit:4	Test of Significance	9 hours

Contingency table –Test for independence by contingency tables –goodness of fitness tests –tests of homogeneity of variances, correlation and proportions .Test of Normality (application only).

Unit:5	**Non-parametric Tests**	**9 hours**
Elementary ideas on distribution – free and non-parametric tests –Run, Median, Sign and Mann Whitney tests (without proof)- Equality of two distributions.		
Unit:6	**Contemporary Issues**	**2 hours**
Expert lectures, Online seminars– Webinars		
	Total Lecture hours	**47 hours**

Text Book(s)

1	Hoel, P. G. (1984). Introduction to Mathematical Statistics, 5th Edition, Wiley, New York.
2	Gupta, S.C., and Kappor, V. K. (2020). Fundamentals of Mathematical Statistics, 12th Edition, Sultan Chand & Sons (Publisher), New Delhi, India
3	Hogg, R., McKean, J., and Craig, A. (2012). Introduction to Mathematical Statistics, 7th Edition, Pearson, New York, US.

Reference Books

1	Brunk, H. D. (1965). An Introduction to Mathematical Statistics, Blaisdell Publishing Company, US
2	Conover, W. J. (1998). Practical Non-parametric Statistics, 3rd Edition, Wiley International, New York, US.

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

1	https://nptel.ac.in/courses/103/106/103106120/
2	https://nptel.ac.in/content/storage2/courses/103106120/LectureNotes/Lec3_1.pdf
3	https://nptel.ac.in/content/storage2/courses/103106120/LectureNotes/Lec3_4.pdf

Course Designed By: T.Santhi

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	M	M	S	M	M	M	M	M
CO2	S	S	M	S	S	M	M	S	M	S
CO3	S	S	M	M	S	M	S	M	S	M
CO4	S	S	S	M	S	M	M	S	M	S
CO5	S	S	S	M	M	S	M	S	M	M

*S-Strong; M-Medium; L-Low

Course code		TITLE OF THE COURSE	L	T	P	C
Core XII		Statistical Quality Control	3	1	-	4
Pre-requisite		Basic knowledge in descriptive statistics, sampling and probability distributions.	Syllabus Version		2020-21	

Course Objectives:

The main objectives of this course are to:

1. Understand the concepts of statistical quality control
2. Learn concepts and applications of reliability theory

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Understand need for SQC.	K1,K2
2	Understand control chart for attributes np, p, c and u chart.	K2, K3
3	Know the acceptance sampling for attributes – single, double and sequential sampling plans.	K2, K3,K4
4	Quality system standards ISO 9000.	K2, K3,K4
5	Reliability concepts and measures, common life distributions namely exponential, Gamma and Weibull distributions.	K4,K5

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6**– Create

Unit:1	Nature of SQC and Variables Control Charts	9 hours

Need for SQC – Role of frequency distribution – Statistical basis for SQC – variable control charts –$\bar{X}$, R and σ charts.

Unit:2	Attributes Control Charts	9 hours

Control Chart for attributes – np, p, c and u chart – Group control chart, OC and ARL of control charts, CUSUM charts using V- mark and decision intervals (concepts only)

Unit:3	Acceptance Sampling	9 hours

Acceptance sampling for Attributes – Single sampling plan – Double sampling plan – OC, AOQ, ASN and ATI curves – sequential sampling plan and their properties.

Unit:4	Quality System Standards	9 hours

Quality system standards – ISO 9000- Elements of ISO – 9000 – Benefits of ISO 9000- Elements of a quality system – Documentation ISO 9000 accreditation

Unit:5	Basics of Reliability Theory	9 hours

Reliability concepts and measures, components and systems, reliability function, hazard rate, common life distribution viz, exponential, gamma and weibull.

Unit:6	Contemporary Issues	2 hours

Expert lectures, Online seminars– Webinars		
	Total Lecture hours	**47 hours**
Text Book(s)		
1	Gupta, S.C., and Kappor, V. K. (2019). Fundamentals of Applied Statistics, Fourth Edition, Sultan Chand & Sons (Publisher), New Delhi, India.	
2	Montgomery, D. C. (2009). Introduction to Statistical Quality Control, Sixth Edition, Wiley India, New Delhi.	
3	Grant, E. L., and Leavenworth, R. S. (2000). Statistical Quality Control, Seventh Edition, Tata McGraw Hill, New Delhi.	
Reference Books		
1	Biswas, S. (2011). Statistics of Quality Control: Sampling Inspection and Reliability, New Central Book Agency, New Delhi, India.	
2	Duncan, A. J. (2003.). Quality Control and Industrial Statistics, Irwin-Illinois, US.	
3	Bain, L.J and Englehard, M. (1991). Statistical Analysis of Reliability and Life Testing Models, 6th Edition, Marcel Dekker, Inc., New York, US	
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]		
1	http://bmepedia.weebly.com/uploads/2/6/6/8/26683759/unit_4_quality_control.pdf	
2	https://www.win.tue.nl/~adibucch/2WS10/SPClecturenotes.pdf	
3	https://nptel.ac.in/courses/116/102/116102019/	
4	https://nptel.ac.in/content/storage2/courses/112101005/downloads/Module_5_Lecture_3_final.pdf	
Course Designed By: T.Santhi		

Mapping with Programme Outcomes										
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	S	S	M	M	S	M	M	M	M	M
CO2	S	S	M	S	S	M	M	S	M	S
CO3	S	S	M	M	S	M	S	M	S	M
CO4	S	S	S	M	S	M	M	S	M	S
CO5	S	S	S	M	M	S	M	S	M	M

*S-Strong; M-Medium ; Low - L

Elective Courses

Course code		TITLE OF THE COURSE	L	T	P	C
Elective I - A		Psychological Statistics	3	-	-	3
Pre-requisite		Basic level on mathematical computation	Syllabus Version	2020-2021		

Course Objectives:

The main objectives of this course are to:

1. know the application of scaling procedures
2. understand reliability and validity tests
3. know the different types of correlation

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Understand scaling procedures and different scores	K1, K2
2	Know the reliability of test scores and methods for determining test reliability	K2, K3
3	Estimate validity and intelligence quotient	K2, K3, K4
4	Know the Biserial correlation	K3, K4
5	Know the partial and multiple correlation	K3, K4, K5

K1 - Remember; **K2** - Undestand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** – Create

Unit:1	Scaling Procedures	15 hours

Introduction-scaling procedures- Z or σ scores-standard scores-Normalized scores- T-scores-Percentile score-Scaling of rankings in terms of Normal Probability curve-scaling of ratings in terms of Normal Probability curve.

Unit:2	Reliability	15 hours

Reliability of test scores- definition of reliability- index of reliability- Parallel tests- Methods for determining test reliability- the test-retest method- Alternate or parallel forms method- split half method- effect of test length on the reliability of the test- effect of different ranges on the reliability of the test

Unit:3	Estimation of validity	15 hours

Estimation of validity- types of validity- validity and test length- comparison between reliability and validity- Intelligence tests- Mental age- Intelligence quotient

Unit:4	Biserial Correlation	15 hours

Biserial correlation- correlation from fourfold tables- the contingency coefficient- curvilinear relationship.

Unit:5	Partial and multiple correlation	15 hours

Correlation ration- intra-class correlation- partial and multiple correlation- definition- formula for three

variables- limitations- simple problems		
Unit:6	**Contemporary Issues**	**2 hours**
Expert lectures, online seminars – webinars		
	Total Lecture hours	**77 hours**

Text Book(s)	
1	Gupta, S.C., and Kappor, V. K. (2019). Fundamentals of Applied Statistics, Fourth Edition, Sultan Chand & Sons (Publisher), New Delhi, India. (Chapter 8 for Units I, II and III)
2	Gupta, S.C., and Kappor, V. K. (2020). Fundamentals of Mathematical Statistics, 12th Edition, Sultan Chand & Sons (Publisher), New Delhi, India
Reference Books	
1	Garett, H, E. (2005). Statistics in Psychology and Education, (Chapter 14 for Unit IV) Paragon International Publishers.
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://t4tutorials.com/z-score-normalization-Data-mining
2	https://www.yourarticlelibrary.com/statistics-2/determining-reliability-of-a-test-4-methods/92574
3	https://www.real-statistics.com/correlation/biserial-correlation
Course Designed By:T.Santhi.	

Mapping with Programme Outcomes										
Cos	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	S	S	M	M	S	M	M	M	M	S
CO2	S	S	M	S	S	M	M	M	M	S
CO3	S	S	M	M	S	M	S	S	M	S
CO4	S	S	S	M	S	M	M	M	M	S
CO5	S	S	S	M	M	S	M	M	S	M

*S-Strong; M-Medium; L-Low

Course code		TITLE OF THE COURSE	L	T	P	C
Elective - I – B		Actuarial Statistics – III	3	-	-	3
Pre-requisite		Basic level on mathematical computation	Syllabus Version	2020-2021		

Course Objectives:

The main objectives of this course are to:

1. know the different acts of insurance
2. understand National income and five year plans
3. know the life table and mortality

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Understand general insurance and business environment	K1, K2
2	Know the National income and five year plans	K1,K2
3	Understand political environment, income and savings, health and education	K2,K3,K4
4	Know the concept and construction of life table	K2,K5
5	Know the mortality	K4.K5

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** – Create

Unit:1	Insurance	15 hours

Insurance Business Environment – Regularity Environment – Insurance act 1938- Insurance regularity and development authority act 1999, LIC of India act 1956, and General Insurance Business act 1972– Legal Environment – Motor vehicles act 1939 - The public liability insurance act 1991- The Indian steam vessels act 1917- Marine Insurance act 1963- The carriage goods of sea act 1925- Indian Railways act 1890- The carriers act 1865- Indian Post Office act 1898- The carriage air act 1993- Consumer protection act 1986- Indian information technology act 2000 (purposes and salient features of these acts only)

Unit:2	National income and five year plans	15 hours

The Economic environment – National income – 5 year plans, Recession Fiscal policy – Value Added Tax (VAT), Information Technology, Telecommunication Technology, World Economic forum – Agricultural sector – Natural resources.

Unit:3	Political Environment	15 hours

Political Environment, Pollution-age profile, Income and savings, education, health, Employment spending and saving patterns, Readership, ethos and culture

Unit:4	Life table	15 hours

Life table – Features – source of information – construction, interpretation, human mortality, Life table function, Non-integer ages uniform distribution of deaths.

Unit:5	Mortality	15 hours
Constant force of mortality, Mortality, characteristics, shape of q_x, l_x, and d_x. Evaluation of means and variance with and without life table.		
Unit:6	**Contemporary Issues**	**2 hours**
Expert lectures, online seminars – webinars		
	Total Lecture hours	**77 hours**

Text Book(s)	
1	IC-12 Insurance Business Environment, By S.Balachandran Insurance Institute of India
2	CT-5 General Insurance, Life and health contingencies, Institute of Actuaries of India.

Reference Books	
1	Jarvis, R. A. (2016), Finding Life at the Table, XLIBRIS
2	Hitchens, . (2014). Mortality, Twelve (Hacbette Book Group), US.

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://www.cengage.co.in/category/higher-education/business-economics/finance/insurance/insurance-business-environment-and-insurance-company-operations-8o
2	https://en.wikipedia.org/wiki/National_fiscal_policy_response_to_the_Great_Recession
3	https://infinityisreallybig.com/2019/04/09/constant-force-of-mortality-exponential-distribution

Course Designed By:T.Santhi

Mapping with Programme Outcomes										
Cos	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	S	S	M	M	S	M	M	S	S	M
CO2	S	S	M	S	S	M	M	S	S	M
CO3	S	S	M	M	S	M	S	S	S	M
CO4	S	S	S	M	S	M	M	S	S	S
CO5	S	S	S	M	M	S	M	M	M	S

*S-Strong; M-Medium; L-Low

Course code		TITLE OF THE COURSE	L	T	P	C
Elective - I – C		Big Data Analytics	3	-	-	3
Pre-requisite		Basic level on mathematical computation	Syllabus Version	2020-2021		

Course Objectives:

The main objectives of this course are to:

1. know the types of Data
2. know the Data science
3. know the big Data technology

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Understand the different types of Data	K1,K2
2	Understand the relation between Data science and statistics	K1,K2
3	Know Evolution of Big Data, Sources of Big Data and Big Data Exploration	K2,K3
4	Know the Big Data Technology Potentials	K2,K3
5	Know the Big Data industry applications	K3,K4,K5

K1 - Remember; **K2** - Undestand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** – Create

Unit:1	Types of Data	15 hours

Introduction – Data – Information – Data Terminologies – Database – Data Mining – Data Warehouse – Data Evolution Roadmap – Big Data – Definition – Type of Data – Numeric – Categorical – Graphical – High Dimensional Data — Data Classification – Hot Data – Cold Data – Warm Data – Thick Data – Thin Data - Classification of digital Data: Structured, Semi-Structured and Un-Structured- Data Sources - Time Series – Transactional Data – Biological Data – Spatial Data – Social Network Data –

Unit:2	Data Science	15 hours

Data Science:Data Science-A Discipline – Data Science vs Statistics, Data Science vs Mathematics, Data Science vs Programming Language, Data Science vsDatabase, Data Science vs Machine Learning. Data Analytics - – Relation: Data Science, Analytics, Big Data Analytics. Data Science Components: Data Engineering, Data Analytics-Methods and Algorithm, Data Visualization.

Unit:3	Big Data	15 hours

Big Data:Digital Data-an Imprint: Evolution of Big Data – What is Big Data – Sources of Big Data. Characteristics of Big Data 6Vs – Big Data Myths - Data Discovery-Traditional Approach, Big Data Technology: Big Data Technology Process – Big Data Exploration - Data Augmentation – Operational Analysis – 360 View of Customers – Security and Intelligence.

Unit:4	Big Data Technology Potentials	15 hours

Big Data Technology Potentials – AI – Machine Learning – Cloud Computing – Mobile

Communication – IoT – Big Data in Industry 4.0- Big Data Platforms – HADOOP – SPARK – No SQL Databases - Types - Big Data Challenges		
Unit:5	**Big DataIndustry Applications**	**15 hours**
Big Data Use Cases –- Big Data Roles Data Scientist , Data Architect, Data Analyst – Skills – Case Study : Big Data – Customer Insights – Behavioural Analysis – Big Data Industry Applications - Marketing – Retails – Insurance – Risk and Security – Health care		
Unit:6	**Contemporary Issues**	**2 hours**
Expert lectures, online seminars – webinars		
	Total Lecture hours	**77 hours**

Text Book(s)	
1	Bhuvaneswari, V., and Devi, T. (2018). Big Data Analytics, Scitech Publisher.
2	Hu, H., Wen, Y., Chua, T. S., Li, X. (2014). Toward Scalable Systems for Big Data Analytics: A Technology Tutorial, IEEE.

Reference Books	
1	Mayer- Schonberger, V., and Cukier, K. (2013). Big Data: A Revolution that will Transform How We Live Work and Think, Hodder And Stoughton (Publisher)

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://www.toolsqa.com/sql/Data-Database-and-Database-management-system
2	https://priceonomics.com/whats-the-difference-between-Data-science-and
3	https://www.techrepublic.com/blog/big-Data-analytics/the-role-of-the-Data-scientist-in-big-Data

Course Designed By:T.Santhi.

Mapping with Programme Outcomes										
Cos	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	S	S	M	M	S	M	M	M	M	M
CO2	S	S	M	S	S	M	M	M	M	M
CO3	S	S	M	M	S	M	S	M	M	M
CO4	S	S	S	M	S	M	M	M	M	M
CO5	S	S	S	M	M	S	M	S	S	S

*S-Strong; M-Medium; L-Low

Course code		TITLE OF THE COURSE	L	T	P	C
Elective - II – A		Elements of Econometrics	3	-	-	3
Pre-requisite		Basic level on mathematical computation	Syllabus Version	2020-2021		

Course Objectives:

The main objectives of this course are to:

1. know the Scope and objectives of Econometrics
2. understand models of Econometrics and estimation of parameters of econometric models
3. understand themulticollenearity and auto correlation

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Know the scope and objectives of Econometrics	K1,K2
2	Know the models of econometrics	K2,K3
3	Estimate the parameters of models of Econometrics	K3,K4
4	Know multicollinearity	K2,K3
5	Understand Auto correlation	K5,K6

K1 - Remember; **K2** - Undestand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** – Create

Unit:1	Objectives of Econometrics	15 hours

Definition-Scope-objectives of Econometrics-Limitations-Divisions of Econometrics.

Unit:2	Models of Econometrics	15 hours

Single equation model two variable case-Reasons for introducing error term in the model-least square method of estimation and testing of parameters of the model-Estimation of error variance –Simple problems.

Unit:3	Methods of estimation	15 hours

General linear model-Assumptions –Least square method of estimation and testing of the parameters of the models –problems under failure of assumptions.

Unit:4	Multicollinearity	15 hours

Multicollinearity- Effects of multicollinearity – detecting multicollinearity – Remedies – Autocorrelation-sources of autocorrelation- Dubin-watson test-Dummy variables (concept only)-Specification errors.

Unit:5	Econometric problems and auto correlation	15 hours

Econometric models in planning: Mahalanobis four sector model-criticism of the model-problems-problems relating to three variable linear model and test for auto correlation.

Unit:6	Contemporary Issues	2 hours

Expert lectures, online seminars – webinars		
	Total Lecture hours	**77 hours**
Text Book(s)		
1	Johnson, A.C., Johnson, M. B., and Buse, R. C. (1987). Econometrics: Basic and Applied, Maxmillan (Publisher)	
2	Johnston. J. (1997). Econometric Methods, McGraw-Hill International Editions.	
Reference Books		
1	Koutsoyannis. A (2001). Theory of Econometrics, Palgrave Macmillan.	
2	Singh, S. P., Parashar, A. K., and Singh, H. P. (1999) Econometrics and Mathematical Economics, S.Chand & Co., Private Limited, New Delhi, India.	
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]		
1	https://www.dynamictutorialsandservices.org/2014/05/business-economics-meaning-nature-scope.html	
2	https://en.wikipedia.org/wiki/Instrumental_variables_estimation#Interpretation_as_two-stage_least_squares	
3	https://www.yourarticlelibrary.com/economics/mahalanobis-growth-model-and-heavy-industry-strategy-of-development/38376#:~:text=It%20was%20sector%20C%202%20representing%20households%20and,of%20employment%20opportunities.%20In%20keeping%20with%20this%20approach%5D	
Course Designed By:T.Santhi.		

Mapping with Programme Outcomes										
Cos	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	S	S	M	M	S	M	M	S	M	S
CO2	S	S	M	S	S	M	M	S	S	S
CO3	S	S	M	M	S	M	S	S	M	S
CO4	S	S	S	M	S	M	M	S	M	S
CO5	S	S	S	M	M	S	M	M	M	S

*S-Strong; M-Medium; L-Low

Course code		TITLE OF THE COURSE	L	T	P	C
Elective - II – B		Indian Official Statistics	3	-	-	3
Pre-requisite		Basic level on statistical computation	Syllabus Version	2020-2021		

Course Objectives:

The main objectives of this course are to:

1. know the population and agricultural statistics
2. understandindustrial statistics and price statistics
3. know the National sample survey

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Know the population and agricultural statistics	K1,K2
2	Know the industrial statistics and price statistics	K2, K3
3	Know the Indices of Industrial Production and profits	K2, K3
4	Know the trade and financial statistics	K3, K4, K5
5	Know the National sample surveys and National Income compilation	K4, K5

K1 - Remember; **K2** - Undestand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** – Create

Unit:1	**Population Statistics**	**15 hours**

Statistical organization – Population Statistics – Agricultural Statistics – Indices of Agricultural production – Miscellaneous Agricultural Statistics.

Unit:2	**Industrial statistics**	**15 hours**

Industrial statistics – ASI – Indices of Industrial Production and profits.

Unit:3	**Price statistics**	**15 hours**

Price statistics – Price index numbers – Labour Bureau; Index number of Retail prices – Indices of security prices.

Unit:4	**Financial statistics**	**15 hours**

Wage statistics – trade statistics – Financial statistics – National income statistics.

Unit:5	**National Income compilation**	**15 hours**

National sample surveys – Activities and publications of CSO and the Department of Statistics, Government of Tamil Nadu. National Income compilation.

Unit:6	**Contemporary Issues**	**2 hours**

Expert lectures, online seminars – webinars

	Total Lecture hours	**77 hours**

Text Book(s)

1	Gupta, S. P. (2011). Statistical Methods, Sultan Chand & Sons, New Delhi, India
2	Saluja, M. R. (1972). Indian Official Statistical System, Statistical Publishing Society, Kolkata
Reference Books	
1	Central Statistical Organisation, Guide to Official Statistics 1979 Ed Department of Statistics, Ministry of Planning, India
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://agriculture.uk.gov.in/pages/show/221-agriculture-statistics-Data
2	http://labourbureau.gov.in/CPIW05%20Methodolgy.html
3	https://byjus.com/free-ias-prep/nsso
Course Designed By:T.Santhi.	

Mapping with Programme Outcomes										
Cos	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	S	S	M	M	S	M	M	M	M	M
CO2	S	S	M	S	S	M	M	M	M	M
CO3	S	S	M	M	S	M	S	M	M	M
CO4	S	S	S	M	S	M	M	M	M	M
CO5	S	S	S	M	M	S	M	S	S	S

*S-Strong; M-Medium; L-Low

Course code		TITLE OF THE COURSE	L	T	P	C
Elective - II – C		Genitcal Statistics	3	-	-	3
Pre-requisite		Basic level on mathematical computation	Syllabus Version	2020-2021		

Course Objectives:

The main objectives of this course are to:

1. know the Elements of Genetics
2. understand Mandel's Law of inheritance and Use of $\chi 2$ (chi-square) tests in testing the Mendel's segregation law
3. know the Method of maximum likelihood and other methods of estimation

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Understand the Elements of Genetics	K1,K2
2	Know the Mandel's Law of inheritance	K2,K3
3	Understand Concept of gene frequency and concept of random mating detection	K2,K3,K4
4	Understand method of maximum likelihood estimation	K4,K5
5	Understand Multiple allelic systems	K2,K4,K5

K1 - Remember; **K2** - Undestand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** – Create

Unit:1	Elements of Genetics	15 hours

Elements of Genetics: Physical basis of heredity-cell structure chromosomes and genes – Interaction of genes concept of genotypes and phenotypes –Linkage and crossing over-Genetic maps.

Unit:2	Mandel's Law of inheritance	15 hours

Mandel's Law of inheritance –Laws of segregation and independent assortment –concept over generation.

Unit:3	Use of $\chi 2$ (chi-square) tests in testing the Mendel's segregation law	15 hours

Use of $\chi 2$ (chi-square) tests in testing the Mendel's segregation law-Sex linked genes –Concept of gene frequency –concept of random mating detection and estimation of linkage from back cross, F_2,& F_3 Data

Unit:4	Maximum likelihoodestimation	15 hours

Method of maximum likelihood and other methods of estimation- Planning of experiments.

Unit:5	Multiple allelic systems	15 hours

Multiple allelic systems-Elementary aspects of the study of human blood group.

Unit:6	**Contemporary Issues**	**2 hours**
Expert lectures, online seminars – webinars		
	Total Lecture hours	**77 hours**

Text Book(s)	
1	Sinott, E. (1958). Principles of Genetics, 5th Edition, McGraw Hill.
2	Mather, K., and Jinks, J. L. (1977). Introduction to Biometrical Genetics, Springer, US.
3	Mather, K. (1963). Measurement of Linkage in Heredity, John Wiley & Sons, New York, US.
Reference Books	
1	Kempthorne, O. (1957). An Introduction to Genetic Statistics, John Wiley & Sons, New York, US.
2	Mackay, T. F. C., and Falconer, D. S. (1995). Introduction to Quantitative Genetics, Longman (Publisher)
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://en.wikipedia.org/wiki/Mobile_genetic_elements
2	https://byjus.com/biology/mendel-laws-of-inheritance/#:~:text=Mendel%27s%20Laws%20of%20Inheritance%20Inheritance%20can%20be%20defined,that%20the%20offsprings%20are%20similar%20to%20the%20parents
3	https://www.encyclopedia.com/science-and-technology/biology-and-genetics/genetics-and-genetic-engineering/multiple-alleles#:~:text=multiple%20alleles%20Three%20or%20more%20alternative%20forms%20of,present%20in%20an%20individual.%20A%20Dictionary%20of%20Biology
Course Designed By:T.Santhi.	

Mapping with Programme Outcomes										
Cos	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	S	S	M	M	S	M	M	M	M	S
CO2	S	S	M	S	S	M	M	M	M	S
CO3	S	S	M	M	S	M	S	S	M	S
CO4	S	S	S	M	S	M	M	M	M	S
CO5	S	S	S	M	M	S	M	M	S	M

*S-Strong; M-Medium; L-Low

Course code		TITLE OF THE COURSE	L	T	P	C
Elective - III – A		Operations Research	3	-	-	3
Pre-requisite		Basic level on mathematical computation	Syllabus Version	2020-2021		

Course Objectives:

The main objectives of this course are to:

1. know the methods of solution of linear programming
2. understand the concept and solution of Transportation problems
3. know the assignment problem, problem of sequencing and network analysis

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Understand methods of solving linear programming problem	K1,K2
2	Know the concept and solution of Transportation problems	K2,K3,K5
3	Understand the concept and solving assignment	K2,K3,K5
4	Understand the concept and solving sequencing problem	K2,K3,K5
5	Understand the network analysis	K2,K3,K5

K1 - Remember; **K2** - Undestand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** – Create

Unit:1	Linear programming problem	15 hours

Origin, Meaning and Scope of operations Research –operations research model building, their types and the outline of the methods of solution. Linear programming**:** optimization problem - programming problem – solution by graphical method, simplex method – slack, surplus and artificial variables - Improving a basic feasible solution- optimality conditions. Degeneracy (Concept only) and breaking ties – Charne's Big M – technique-conversion of a minimization problem to a maximization problem.

Unit:2	Transportation problems	15 hours

Transportation problems :Introduction – the simplex method and transportation problems – obtaining an initial and feasible solution – by North – West corner rule – Vogel's method – Least cost entry method – MODI method for optimality. Degeneracy (concept only).

Unit:3	Assignment problem	15 hours

Assignment problem: The assignment problem as a special case of the transportation problem – solving the problem.

Unit:4	Sequencing problem	15 hours

Sequencing**:** Introduction – n jobs and two machines, n jobs and three machines, n jobs and m machines – idle times and total elapsed time calculations.

Unit:5	Network analysis	15 hours

Network analysis**:** Introduction – Network construction – Critical path method (CPM) – Labelling method – Method based on time estimates – Earliest and latest times. Project evaluation and Review techniques (PERT) – Algorithm for PERT - Difference between CPM and PERT. - Simple problems.		
Unit:6	**Contemporary Issues**	**2 hours**
Expert lectures, online seminars – webinars		
	Total Lecture hours	**77 hours**

Text Book(s)	
1	Kanti Swarup, Gupta, P. K., and Man Mohan. (2017). Operations Research, Nineteenth Edition, Sultan Chand & Sons, New Delhi.
2	Sharma, S. D. (2017). Operations Research: Theory, Methods and Applications, Kedar Nath, Ram Nath and Co, Meerut.
Reference Books	
1	Taha, H. A. (1982). Operations Research: An Introduction, 3rd Edition, McMillan Publishing Co., Inc., London.
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://en.wikipedia.org/wiki/Linear_programming
2	https://www.geeksforgeeks.org/transportation-problem-set-1-introduction
3	https://en.wikipedia.org/wiki/Network_analysis_%28electrical_circuits%29
Course Designed By:T.Santhi.	

Mapping with Programme Outcomes										
Cos	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	S	S	M	M	S	M	M	M	S	S
CO2	S	S	M	S	S	M	M	M	S	S
CO3	S	S	M	M	S	M	S	M	S	S
CO4	S	S	S	M	S	M	M	M	S	S
CO5	S	S	S	M	M	S	M	S	M	M

*S-Strong; M-Medium; L-Low

Course code		TITLE OF THE COURSE	L	T	P	C
Elective - III – B		Data Analytics using R	3	-	-	3
Pre-requisite		Basic level on statistical computation	Syllabus Version	2020-2021		

Course Objectives:

The main objectives of this course are to:

1. know the concept and types of Data Analytics
2. understand R features
3. know the Data Summarization & Visualization

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Understand the concept and types of Data Analytics	K1,K2
2	Know the R features	K2,K4
3	Understand the Data Summarization & Visualization	K2,K3,K4
4	Understand Analysing Gathering Information	K2,K3,K4
5	Understand the Data Analytics Case Studies	K3,K4,K5

K1 - Remember; **K2** - Undestand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** – Create

Unit:1	Data Analytics	15 hours

Introduction Data Analytics – Data Analysis VsData Analytics – Data Analytics – Types – Data Analytics – Framework – Data Analytics – Tool - R language - Understanding R features - Installing R and RStudio – Packages and Library – Importing and Exporting Files: CSV File – JSON File – txt File –Excel File – Xml File - Command Line Vs. Scripts. - Data Pre-Processing – Missing Value – Omitting Null Values – Data Transformation – Data Selection – Data Integration –

Unit:2	R features	15 hours

Understanding R features - Installing R and RStudio – Packages and Library – Importing and Exporting Files: CSV File – JSON File – txt File –Excel File – Xml File – Command Line Vs. Scripts Data Manipulation: Slicing - Subscripts and Indices – Data Subset – Dplyr Package: Select Function - Filter Function - Mutate Function - Arrange Function –

Unit:3	Data Summarization & Visualization	15 hours

Data Summarization & Visualization - Mean – Median – Mode - Variablity Measures - Variance – Range - IQR – Standard Deviation – Sum of Squares –Identifying Outliers using IQR. Data Visualization – Introduction – Datasets – Exploratory Data Analytics – Univariate Analysis – Histogram - Bivariate Analysis - Box Plot – Multivariate Analysis - Scatter Plot - MASS Package - Categorical Variable –Bar Chart – Mosaic Plot.

Unit:4	Analysing Gathering Information	15 hours

Reporting Tool – Analysing Gathering Information – Story Telling – R Markdown – R Markdown

Framework - rmarkdown package – Knit for Embedded Code: knitr package - Convert File:HTML, PDF, MS Word - Markdown Formatted Text - ShinyApp – shiny package: Built Shiny app – Control Widgets – Customize Reactions – Reactive Expressions - Customize Appearance - Deploy Shiny app.		
Unit:5	**Data Analytics Case Studies**	**15 hours**
Data Analytics Case Studies – Marketing – Logistic Management – Insurance – Behavioural Analytics – Data Analytics on Diamond Dataset		
Unit:6	**Contemporary Issues**	**2 hours**
Expert lectures, online seminars – webinars		
	Total Lecture hours	**77 hours**

Text Book(s)	
1	Bhuvaneswari, V. (2016). Data Analytics with R Step by Step, Scitech Publisher.
2	Peng, R. D. (2014). R Programming for Data Science, Lean Publishing.
3	Prajapati, V. (2013). Big Data Analytics with R and Hadoop, Packt Publishing.

Reference Books	
1	Feldman, r., and Sanger, J. (2006). The Text Mining Handbook: Advanced Approaches in Analysing Unstructured Data, Cambridge University Press
2	Paradis, E. (2005). R for Beginners.

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://en.wikipedia.org/wiki/Data_analysis
2	https://www.tutorialspoint.com/r/r_overview.htm
3	https://en.wikipedia.org/wiki/Case_study

Course Designed By:T.Santhi.

Mapping with Programme Outcomes										
Cos	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	S	S	M	M	S	M	M	M	M	M
CO2	S	S	M	S	S	M	M	M	M	M
CO3	S	S	M	M	S	M	S	S	S	M
CO4	S	S	S	M	S	M	M	M	M	M
CO5	S	S	S	M	M	S	M	M	M	M

*S-Strong; M-Medium; L-Low

Course code		TITLE OF THE COURSE	L	T	P	C
Elective - III – C		Quantitative Techniques for Managerial Decisions	3	-	-	3
Pre-requisite		Basic level on mathematical computation	Syllabus Version	2020-2021		

Course Objectives:

The main objectives of this course are to:

1. know the Basic principles of accountancy
2. understand Tools of financial analysis
3. know the Analysis of operating and financial leverages

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Understand the Basic principles of accountancy	K1,K2
2	Know the Tools of financial analysis	K2,K3
3	Understand Analysis of operating and financial leverages	K2,K3,K4
4	Know the Approaches to financial forecasting	K2,K3,K4
5	Understand the project analysis	K3,K4,K5

K1 - Remember; **K2** - Undestand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** – Create

Unit:1	**Principles of accountancy**	**15 hours**

Basic principles of accountancy and analysis of balance sheets

Unit:2	**Financial analysis**	**15 hours**

Tools of financial analysis-Flow of funds, analysis-Cost, Volume, Profit analysis

Unit:3	**Financial leverages**	**15 hours**

Analysis of operating and financial leverages.

Unit:4	**Financial forecasting**	**15 hours**

Approaches to financial forecasting.

Unit:5	**Project analysis**	**15 hours**

Project analysis.

Unit:6	**Contemporary Issues**	**2 hours**

Expert lectures, online seminars – webinars

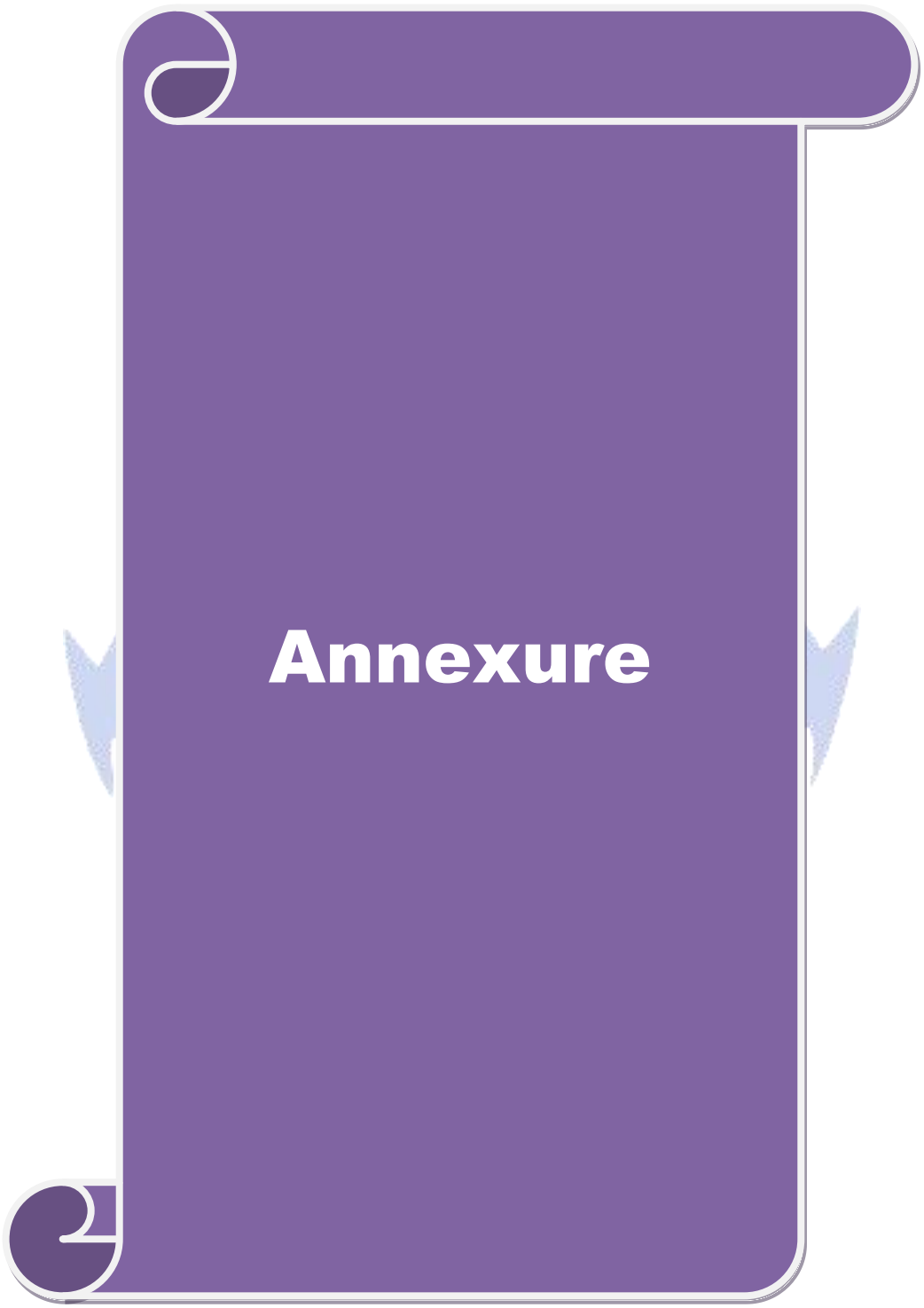
	Total Lecture hours	**77 hours**

Text Book(s)

1	Kuchhal, S. C. (1972). Financial Management, 2nd Edition, Chaitanya Publishing House.
2	Development : Manual of Industrial Project Analysis in Centre of the Developing countries. Organization for Co-operation and Development, Paris
3	Foreign and : Project Appraisal: check Lists and Discounting Common Wealth Tables. Office (London)
Reference Books	
1	Basu, A. (2000). Principles and Application of Financial Accounting, Tee Dee Publications..
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://www.myaccountingcourse.com/accounting-principles
2	https://en.wikipedia.org/wiki/Financial_analysis
3	https://www.examples.com/business/project-analysis-examples-pdf.html
Course Designed By:T.Santhi.	

Mapping with Programme Outcomes										
Cos	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	S	S	M	M	S	M	M	M	M	M
CO2	S	S	M	S	S	M	M	M	M	M
CO3	S	S	M	M	S	M	S	S	S	M
CO4	S	S	S	M	S	M	M	M	M	M
CO5	S	S	S	M	M	S	M	M	M	S

*S-Strong; M-Medium; L-Low


Annexure

B. Sc., Statistics

Syllabus

(with effect from 2020 – 21)

Program Code:

DEPARTMENT OF STATISTICS

Bharathiar University

(A State University, Accredited with "A" Grade by NAAC and 13th Rank among Indian Universities by MHRD-NIRF)

Coimbatore 641 046, INDIA

BHARATHIAR UNIVERSITY, COIMBATORE 641046
DEPARTMENT OF STATISTICS

MISSION

The course aims to encourage students to acquire knowledge on theoretical and applied areas of Statistics in a wider range. It intends to create awareness on the importance of the concepts of statistics in various fields of study and to provide practical training on the applications of statistical methods for carrying out analysis of data using programming knowledge such as R and C++. The course is designed in such a way to help the students to pursue higher studies in Statistics and to get placements on successful completion of the course.

List of Elective papers (Colleges can choose any one of the paper as electives)		
Elective I	A	Psychological Statistics
	B	Actuarial Statistics – III
	C	Big Data Analytics
Elective II	A	Elements of Econometrics
	B	Indian Official Statistics
	C	Genetical Statistics
Elective III	A	Operations Research
	B	Data Analytics using 'R'
	C	Quantitative Techniques for Managerial Decisions