A.VEERIYA VANDAYAR MEMORIAL

SRI PUSHPAM COLLEGE (AUTONOMOUS)

POONDI-613 503, THANJAVUR (DT)

SYLLABUS

B.Sc., Statistics

(From 2020 - 2021 onwards)

ProgrammeOutcomesofB.Sc.Statistics

PO1 **Apply the theoretical knowledge in statistics to real life situations**

PO2 **TheUGcurriculumoffersneedbasedcomputercourseswhichenablethe students to solve computer oriented statistical problems andexpert inSPSS.**

PO3 **Apply the concepts, principles and methods of statistics to various fields of study.**

PO4 **Oncompletionoftheprogramthestudentsarewellpoisedtopursuecareersinacademia,industryandtheotherareasof Statistics.**

PO5 **Get opportunities for job placements in various sectors**

PO6 **Apply the concepts, principles and methods of statistics to various fields of study**

PO7 **Identify diversified areas of applications of statistical theory**

PO8 **Understand the importance and value of statistical principles**

Programme SpecificOutcomesofB.Sc.Statistics

PSO1 **Realize the importance of statistics andsociety.**

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 Page**

B.Sc. STATISTICS (2020 – 2021)

Sl. No	Sem.	Category	Paper Code	Title of the Paper	Maximum Marks			Minimum Marks for Pass			Hours / Week	Credits
					CIA	EE	Total	CIA	EE	Total		
1	I	Part – I	20U1STT1/H1	Tamil – I / Hindi – I	25	75	100	10	30	40	6	3
2		Part – II	20U1STE1	English – I	25	75	100	10	30	40	6	3
3		Core	20U1STC1	Descriptive Statistics	25	75	100	10	30	40	5	5
4		Core	20U1STC2	Probability Theory and Random Variables	25	75	100	10	30	40	5	5
5		Allied	20U1STMAA1	Allied Mathematics-I	25	75	100	10	30	40	5	4
6		Allied (NS)	20U2STMAA2	Allied Mathematics - II (N.S)	-	-	-	-	-	-	-	-
8		ES	20U1STES	Environmental Studies	-	-	100	-	-	-	-	1
9	II	Part – I	20U2STT2/H2	Tamil – II / Hindi – II	25	75	100	10	30	40	6	3
10		Part – II	20U2STE2	English – II	25	75	100	10	30	40	6	3
11		Core	20U2STC3	Discrete Distributions	25	75	100	10	30	40	5	5
12		Core	20U2STCPL1	Major Practical - I (Descriptive Statistics)	40	60	100	16	24	40	4	3
13		Allied (NS)	20U2STMAA2	Allied Mathematics –II(NS)	25	75	100	10	30	40	3	4
14		Allied	20U2STMAA3	Allied Mathematics –III	25	75	100	10	30	40	5	4
15		Skill Based Education-I	20U2STS1	Verbal Reasoning-I	25	75	100	10	30	40	1	1
16		Value Based Education	20U2STVE	Value based Education	-	-	100	-	-	-	-	-
17	III	Part – I	20U3STT3/H3	Tamil – III / Hindi – III	25	75	100	10	30	40	6	3
18		Part – II	20U3STE3	English – III	25	75	100	10	30	40	6	3
19		Core	20U3STC4	Continuous Distributions	25	75	100	10	30	40	5	5
20		Core	20U3STC5	Statistical Inference – I: Theory of Estimation	25	75	100	10	30	40	5	5
21		Allied	20U3STCSA1	Allied Computer Programming in C	25	75	100	10	30	40	5	3
22		Allied (NS)	20U4STCSAPL	Allied Computer Practical (N.S)	-	-	-	-	-	-	3	-
24		GS	20U3MAGS	Gender Studies	-	-	100	-	-	-	-	-
		MDOC	-	Massive open online Course-I	-	-	-	-	-	-	-	-

Sl. No	Sem.	Category	Paper Code	Title of the Paper	Maximum Marks			Minimum Marks for Pass			Hours/ Week	Credits
					CIA	EE	Total	CIA	EE	Total		
25	IV	Part – I	20U4STT4/H4	Tamil-IV / Hindi-IV	25	75	100	10	30	40	6	3
26		Part – II	20U4STE4	English – IV	25	75	100	10	30	40	6	3
27		Core	20U4STC6	Statistical Inference - II : Testing of Hypothesis	25	75	100	10	30	40	5	5
28		Core	20U4STC7	Sampling Techniques	25	75	100	10	30	40	4	4
29		Allied	20U4STCSA2	Allied Data Mining	25	75	100	10	30	40	5	3
30		Allied (NS)	20U4STCSAPL	Allied Computer Practical (N.S)	40	60	100	16	24	40	3	2
31		Skill Based Education-II	20U4STS2	Verbal Reasoning -II	25	75	100	10	30	40	1	1
		MOOC	-	Massive open online Course – II	-	-	-	-	-	-	-	-
32	V	Core	20U5STC8	Stochastic Processes	25	75	100	10	30	40	5	6
33		Core	20U5STC9	Statistical Quality Control	25	75	100	10	30	40	5	6
34		Core	20U5STC10	Design of Experiments	40	60	100	16	24	40	4	5
		Core	20U5STCPL2	Major Practical -II (Using Calculator)	40	60	100	16	24	40	5	3
35		Major Elective	20U5STEL1A 20U5STEL1B	Demographic Methods (or) Econometrics	25	75	100	10	30	40	4	3
36		Major Elective	20U5STEL2A 20U5STEL2B	Simulation and Probabilistic Model (or) MATLAB	25	75	100	10	30	40	4	4
37		Non Major Elect	20U5STNME	Non-Major Elective: (Matrix Algebra)	25	75	100	10	30	40	2	1
38		Soft Skill Develo	20U6STSSD	Soft Skill Development (NS)	-	-	100	-	-	-	1	-
40	VI	Core	20U6STC11	Numerical Analysis	25	75	100	10	30	40	4	5
41		Core	20U6STC12	Operations Research	25	75	100	10	30	40	5	5
42		Core	20U6STC13	Statistics Using R	40	60	100	16	24	40	4	5
		Core	20U6STCPL3	Major Practical -III (Using Statistical Software Package)	40	60	100	10	30	40	5	3
43		Major Elective	20U6STEL3A 20U6STEL3B	Actuarial statistics (or) Genetical Statistics	25	75	100	10	30	40	5	3
44		Major Elective	20U6STEL4A 20U6STEL4B	Time series and Index numbers (or) Statistical Data Analysis	25	75	100	10	30	40	5	4
46		GK	20U6STGK	GK	-	-	100	-	-	-	1	-
		Comp. Test		Comprehensive Test	-	-	100	-	-	-	1	1
47		Extension Activit	20U6STEA	Extension Activities	-	-	-	-	-	-	-	1

Abbreviations

ESE: Environmental studies	LSD: Life Skill Development
VBE: Value Based Education	GK : General Knowledge
SBE: Skill Based Elective	NME: Non – Major Elective
GS: Gender Studies	EA: Extension Activities
ME: Major Elective	SS: Self Study
CC: Certificate Course	
MOOC-Massive open online course	

Parts	Total No. of course	Total Marks	Total Credits
Part – I	**04**	**400**	**12**
Part – II	**04**	**400**	**12**
Part – III		**2600**	
Core Major	16		76
Core Allied	06		20
Major Elective	04		14
	……..		……
	26		**110**
	…….		……
Part – IV			
E.S	01	100	01
VBE	01	100	00
SBE	02	200	02
SSD	01	100	00
NME	01	100	01
G.S	01	100	00
G.K	01	100	00
Comp Test	01	100	01
	……..	**…….**	**……**
	09	**900**	**05**
	……	**…….**	**……**
Part – V			
EA			**01**
	43	**4300**	**140**

Comprehensive Knowledge Test: Objective type question patternwith 100 compulsory questions carrying 100 marks to be answered in 3 Hours with 2 Credits. The portion is entire core courses.

MOOC: Massive open online course is introduced in the third and fourth semester as an extra credit course from this academic year 2020-2021. Students can avail any one or more of the courses available in MOOC to equip their skill and knowledge themselves

Field Visit / Industrial Visit / Hands on training programme having minimum 15 hours of contact time as Extra Credit course is introduced for II year UG students to gain experiential learning

Evaluation of the visit report will be held at the end of IV Semester.

Components of Evaluation

Internal Marks	40
External marks	60
Total	100

Project is introduced for III year students to cater for the needs of advanced learners as extra credit course

Components of Evaluation

Internal Marks	40
External marks	60
Total	100

Soft skill development course prescribed in V semester is changed as Life Skill Development.

This course will be handled by both Internal Staff and External Experts.

Mode of Assessment for this course is oral examination.

Components of Evaluation

Internal Marks	40
External marks	60
Total	100

Skill Based Elective Offered by the Statistics Department

1. Verbal Reasoning -I
2. Verbal Reasoning -II

Non – Major Elective paper offered by the StatisticsDepartment

Matrix Algebra

A.VEERIYA VANDAYAR MEMORIAL SRI PUSHPAM COLLEGE (AUTONOMOUS),
POONDI, THANJAVUR DIST.

Question Pattern for UG and PG Programmes for students to be admitted during 2020 – 2021 and afterwards

Total Marks: 75

QUESTION PATTERN

SECTION – A
(Question 1 to 10)

10x 2 = 20 Marks

1. Short Answer Questions
2. Two Questions from each units (All are answerable)

SECTION – B
(Question 11 to 15)

5 x 5 = 25 Marks

1. 5 Paragraph type questions with "either / or" type choice.
2. One question from each unit of the Syllabus.
3. Answer all the questions.

SECTION – C
(Question 16 to 20)

3 x 10 = 30 Marks

1. 5 Essay type questions – any three are answerable.
2. One questions from each unit of the Syllabus.

Semester	Subject Code	Title Of The Paper	Hours Of Teaching / Week	No. of Credits
I	**20U1STT1**	**இக்கால இலக்கியம்** **(செய்யுள் , உரைநடை, சிறுகதை, புதினம், நாடகம் இலக்கிய வரலாறு)**	**6**	**3**

நோக்கம்

1. இக்கால இலக்கிய வகைகளைக் கண்டறிவர்

2.எழுத்து,சொல் இலக்கணங்களின் அடிப்படைகளைக் கண்டறிவர்.

3.புதுக்கவிதை வாயிலாக வெளிப்படும் சமூக,அரசியல்விழுமியங்களை மதிப்பிடுவர்.

4. இக்கால இலக்கியத்தின் மீதான விருப்பத்தை மிகுவித்தல்.

கூறு:1செய்யுள் ***நேரம்:18***

1. பாரதியார் : கண்ணன் என் காதலன்,கண்ணம்மா என் காதலி (முதல்பாடல் மட்டும்)

2. பாரதிதாசன் : தமிழின் இனிமை,தமிழ் உணர்வு

3. கவிமணி : ஒற்றுமையே ,உயர்நிலை-நாட்டுக்குழைப்போம்

4. சுரதா : சிக்கனம்

கூறு:2செய்யுள் ***நேரம்:18***

1. பட்டுக்கோட்டை கல்யாணசுந்தரம்:நாட்டுக்கொரு வீரன்

2. கண்ணதாசன் : காலக்கணிதம்

3. மு.மேத்தா: கண்ணீர் பூக்கள் ,ஊர்வலம்,தாய் ,வெளிச்சம் வெளியே இல்லை

4. அப்துல் ரகுமான் : தேவகானம் - தேர்ந்தெடுக்கப்பட்ட 5 பாடல்கள்

கூறு:3சிறுகதை ***நேரம்:18***

1. கேட்டிவி : குரல்கொடுக்கும் வானம்பாடி (1-10)

2. கேட்டிவி : மனோரஞ்சிதம் (1-10)

கூறு:4புதினம் ***நேரம்:18***

புதினம் : துணிந்தவன் - வல்லிக்கண்ணன்

கூறு:5 நாடகம், இலக்கிய வரலாறு ***நேரம்:18***

1.நாடகம் : மாமன்னன் இராசராசன் - கு.வெ.பாலசுப்பிரமணியன்

2.இலக்கிய வரலாறு : இருபதாம் நூற்றாண்டு இலக்கியங்கள்

பயன்கள்

1. தமிழ் இலக்கியத்தின் மீதான ஆர்வம் மிகும்.

2. புதிய இலக்கிய வளங்களை அறிவர்.

3. கவிதை, சிறுகதை ஆகியவற்றைப் படைக்க முயல்வர்.

4. போட்டித் தேர்வுகளுக்குச் செல்பவர்கள் பயன் பெறுவர்.

5. நாடகக் கலைத்திறனை அறிவர்

Semester	Course Code	Title of The Course	Hours of Teaching / Week	No. of Credits
I	**20U1STE1**	**PART – II - Prose, Poetry and Communication Skills**	**6**	**3**

Objective

- **To initiate the students to understand English through Prose, Poetry and Basic Communicative Grammar.**

Unit – I

Shakespeare - Shall I Compare Thee to a Summer's Day?
John Milton – On His Blindness
William Wordsworth – The Solitary Reaper
P.B.Shelley – Song to the Men of England
Robert Frost – The Road not Taken
Nissim Ezekiel - Night of the Scorpion

Unit – II

1) The Running Rivulets of Man,
2) Parliament is Marking Time
3) The Lady in Silver Coat,
4) Mr. Applebaum at Play

Unit – III

1) The Feigning Brawl of an Impostor,
2) Thy Life Is My Lesson
3) Solve the Gamble,
4) The Stoic Penalty

Unit – IV

1) Nobility in Reasoning,
2) Malu the Frivolous Freak
3) Bharath! Gird Up Your Loins!
4) Honesty is the Cream Of Chastity

Unit – V

Parts of Speech, Nouns, Pronouns, Conjunctions, Adjectives, Articles, Verbs, Adverbs, Interjection – sentence.

Course outcomes:

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

- **understand and appreciate the English Prose, Poetry and basic functional communicative Grammar and study on style and substance.**
- **develop interest in appreciation of literature**
- **integrate the use of the four language skills: LSRW.**
- **communicate appropriately and use English effectively**
- **imbibe ethical, moral, national and cultural values**

Prescribed Texts:

K.T.V. *A Melodious Harmony.* Thanjavur: Rajendra Publishing House, 2017.
Natarajan, K. *FlyingColours.* Chennai: New Century Book House (P) Ltd., 2017.
Advanced Grammar and Composition. Chennai: New Century Publishing House, 2017.

Semester	Subject Code	Titles of the Paper	Hours of Teaching / Week	No. of Credits
I	**20U1STC1**	**DESCRIPTIVE STATISTICS**	**5**	**5**

Course Objectives:

- To explain the origin, significance and scope of Statistics.
- To impart the significance of presenting data in the form of tables and diagrams.
- To teach computational aspects of basic statistical measures.

UNIT-I: **15 Hrs**

Origin, scope, limitations and Distrust of Statistics-Collection-Classification-Tabulation of data. Diagrammatic representation of data: One-dimensional and twodimensional diagrams – graphic representation: line diagram, frequency polygon, frequency curve, Histogram and Ogive curves.

UNIT-II: **15 Hrs**

Measures of central tendency: Mean, Median, Mode, Geometric mean and Harmonic mean-Partition values: Quartiles, Deciles and Percentiles.

UNIT-III: **15 Hrs**

Measures of Dispersion: Mean deviation, Quartile deviation and Standard deviation – Coefficient of variation.

UNIT-IV: **15 Hrs**

Moments- measures of Skewness-Pearson's and Bowley's Coefficient of skewness, Coefficient of Skewness based on moments – Kurtosis.

UNIT-V: **15 Hrs**

Correlation – Definition – types – properties – karl Pearson coefficient of correlation, spearman's rank correlation Method – simple problems. Regression – Definition - properties-simple problems.

Course Outcomes:

After completion of the course, the student will be able to

- understand and present data meaningfully
- apply summary measures of averages and dispersion to draw useful conclution
- evaluate real-life problems and draw inferences
- construct suitable statistical models to handle various socioeconomic phenomena
- explore problem solving skills in competitive exams like combined statistical subordinate service exam (Group –IV).

Text book:

"Fundamental of Mathematical Statistics" (Sulthanchand&sons) - Guptha, S.C and Kapoor V.K

Unit- I Chapter- I(Sec 1.1 to 1.6) & Chapter II(Sec2.2 to 2.3)
Unit-II Chapter-II(Sec 2.4 to 2.11)
Unit-III Chapter II(Sec 2.12 to 2.14)
Unit-IV Chapter II(Sec 2.15 to 2.17)
Unit-v Chapter II (Sec 2.18 to 2.19)

General ReferenceLinks:

1. **https://www.imperial.ac.uk/engineering/departments/civil-[Imperial college London]**
2. http://collegecatalog.uchicago.edu/search/?P=STAT%2020000[University of Chicago]

Semester	Subject Code	Titles of the Paper	Hours of Teaching / Week	No. of Credits
I	**20U1STC2**	**Probability Theory and Random Variables**	**5**	**5**

Course Objectives:

- To demonstrate the basic principles of probability including the laws for unions, intersections, and complementation, Bayes theorem and use these principles in problem solving situations.
- To teach the definitions of discrete, continuous, and joint random variables, compute the mean,

variance and covariance of random variables, know the definition of mass (density) function and distribution function of a random variable

and distribution function.

- To provide students with the foundations of probabilistic and statistical analysis mostly used in varied applications of real time data.

Unit I : **15 Hrs**

Mathematical Probability and limitations – Statistical Probability and limitation(Simple Problem Only) – Addition theorem of Probability, Conditional Probability – Multiplication Theorem of Probability , Stochastic independence, Baye's Theorem , Boole's Inequality – Proof only.

Unit-II: **15 Hrs**

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-III: **15 Hrs**

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

Unit-IV **15 Hrs**

Mathematical expectation-properties-addition and multiplication theorems – conditional expectation and conditional variance.

Unit-V: **15 Hrs**

Moment generating function, cumulant generating function, characteristic function and their properties - Simple Problems. Uniqueness theorem on M.G.F, Additive probability of M.G.F, Cumulants , Characteristics function, some important theorems .

Course Outcomes:

After completion of the course, the student will be able to

- understand and recall the basic concepts in permutations and combinations and principles of probability theory
- learn the basic probability rules, including additive and multiplicative laws, independent and mutually exclusive events in probability models.
- understand the marginal and conditional distributions of bivariate random variables.
- understand the mathematical expectation and moments and solve the problems related to discrete random variables.
- explore problem solving skills in competitive exams like combined statistical subordinate service exam (Group –IV).

Books for study:

1. *"Fundamentals of Mathematical stat*istics" byGuptha, S.C &Kapoor, V.K (Sulthanchand&sons).
2. *"Introduction to Mathematical statistics"* by Hogg.R.V and and Craig, A.G. (Amerin.,).

   Unit I : Chapter 7: Sec 7.1 to 7.4
   Unit II : Chapter 5: Sec 5.2 to 5.4
   Unit III : Chapter 5: Sec 5.5 to 5.6
   Unit IV : Chapter 6: Sec 6.1 to 6.4
   Unit V : Chapter 6: Sec 6.10 to 6.12

General References Links:

1. https://courses.maths.ox.ac.uk/node/43890[Oxford]
   https://www.maths.cam.ac.uk/undergrad/files/coursesIA.pdf[Cambridge]

B.Sc. (Statistics)

semester	Subject Code	Title of the Paper	Hours of Teaching/Week	No. of Credits
I	**20U1STMAA1**	**Allied Mathematics-I**	**5**	**3**

Objectives:

- To introduce the concept of binomial, exponential and logarithmic series.
- To teach the relation between circular and hyperbolic function.
- To impart the knowledge of the methods to find radius of curvature and centre of curvature.

UNIT-I

Algebra: Binomial series - Application of Binomial theorem to the summation of series - Exponential series - summation of series using exponential series- Logarithmic series.

UNIT-II

Theory of Equations: Nature of roots – Relation between the coefficients and the roots of an algebraic equation – Transformation of equations – Reciprocal Equations.

UNIT-III

Matrices: Eigen values and eigen vectors – Diagonalisation – similar matrices – Cayley-Hamilton theorem – Eigen values for symmetric matrices.

UNIT-IV

Trigonometry: Expansion of $\cos n\theta$, $\sin n\theta$ and $\tan n\theta$ – Powers of Sines and Cosines of θ in terms of multiples of θ – expansion of $\sin\theta$ and $\cos\theta$ in a series of ascending powers of θ – Hyperbolic Functions – Relation between hyperbolic functions.

UNIT-V

Differential Calculus: Curvature – circle, radius and centre of curvature – Cartesian formula for radius of curvature – coordinates of centre of curvature - parametric form - Maxima and minima of a function of two variables.

COURSE OUTCOMES:

After completion of the course, Students will be able to

- find the eigen values, eigen vector of a given matrix.
- calculate centre and radius of curvature.
- apply differential calculus to geometrical problems.
- understand the concept of matrices, in solving a system of linear equation.
- sum the series using binomial, exponential and logarithmic series

Textbook:

Ancillary Mathematics, Volume-I, *S. Narayanan, R. Hanumantha Rao, T.K.Manicavachagom Pillay, S. Viswanathan Printers Pvt. Ltd., 2013.*

Unit I	:	Chapter 1 (Pages: 7 – 17, 28 – 37, 40 - 49)
Unit II	:	Chapter 2 (Pages: 59 – 83)
Unit III	:	Chapter 3 (Pages: 151 – 164)
Unit IV	:	Chapter 5 (Pages: 220 – 247)
Unit V	:	Chapter 6 (Pages: 296 – 309, 318 – 326)

References:

1. ***Allied Mathematics, Paper-I, First Semester****,* P. Kandasamy and K. Thilagavathy, S.Chand & Company Pvt. Ltd., New Delhi, 2014.
2. ***Algebra Volume I***, T.K.M. Pillay, T. Natarajan and K.S.Ganapathy,
3. ***Calculus Volume I***, S. Narayanan and T.K. Manicavachagom Pillay,
4. ***Trigonometry****,* Narayanan and T.K.Manicavachagom Pillay,

Semester	Subject Code	Title of the Paper	Hours of Teaching/Week	No. of Credits
I & II	**20U2STMAA2**	**Allied Mathematics-II**	**3+3**	**4**

Objectives:

- To introduce the concepts of correlation and regression.
- To teach the concepts of interpolation, numerical solution of ordinary differential equation and multiple integrals.
- To enrich the knowledge of application of multiple integrals.

UNIT –I

Correlation and Regression: Karl Pearson coefficient of correlation – Rank correlation – Regression: Regression coefficients – Properties of regression coefficients

UNIT – II

Interpolation: Gregory Newton forward interpolation formula - Backward interpolation formula- Gauss forward interpolation formula - Backward interpolation formula – Lagrange's interpolation formula ***(no proofs, simple problems only)***.

UNIT – III

Numerical solution of ordinary differential equation: Taylor series – Euler's method – Modified Euler's method – R. K method (4^{th} order only).

UNIT – IV

Beta and Gamma Functions: Definitions – Convergence of $\Gamma(n)$ – Recurrence formula of gamma function – Properties of beta function – relation between beta and gamma functions - Problems.

UNIT – V

Multiple integral: Double integral – Evaluation of double integral - change of order of integration – Polar coordinates - Triple integrals - Application of multiple integrals.

Course Outcomes:

After completion of the course, student will be able to,

- give information on the strength and direction of the linear relationship between two variables using correlation.
- find numerical approximations to the solutions of ODE.
- calculate the area of a region, the volume under a surface and the average values of a function of two variables.
- know the relation between beta and gamma function.
- distinguish the overall mathematical knowledge gained to demonstrate and analyze the problems in real life situation.

Text Book:

1. ***Fundamentals of Mathematical Statistics,*** *S.C. Gupta, V. K. Kapoor, Sulthan, 2002.*
   Unit I: Chapter – 10(Sec.10.2–10.4, 10.7), Chapter – 11(Sec.11.1–11.2.2)
2. ***Numerical methods****, P. Kandasamy, Thilagavathi and Gunavathi*
   Unit II: Chapter: 6 (6.1-6.3), Pages: 209 – 225, Chapter: 7 (7.1-7.4), Pages: 231 – 240, Chapter: 8 (8.7 only), Pages: 271 - 276.
   Unit III: Chapter – 11(Sec.11.5, 11.9, 11.11 – 11.3), Pages:352 – 358,369 -389
3. ***Calculus Vol II :*** *T.K. M. Pillai, 2015*
   Unit IV: Chapter 7 (Sec: 2 – 5)
   Unit V : Chapter 5 (Sec: 2 – 5.3)

General References:

1. Statistics - M. Sivathanupillai
2. Ancillary Maths - P.R.,Vittal, Margam Publications.

Semester	Subject Code	Title Of The Paper	Hours Of Teaching/ Week	No. of Credits
II	**20U2STT2**	**இடைக்கால இலக்கியம் – பயன்முறைத் தமிழ் –இலக்கண இலக்கிய வரலாறு,**	**6**	**3**

நோக்கம்

1. தமிழிலக்கிய வரலாற்றில் பக்தி இலக்கியங்கள் பெறும் சிறப்பை உணர்வர்.

2. சமய வழிச் சமூக மாற்றத்திறன் பெறுவர்.

3. சமய நல்லிணக்க உணர்வை மாணவர்கள் பெறுவர்.

கூறு: 1 ***நேரம்:18***

1. திருஞானசம்பந்தர் தேவாரம் : சீகாழி திருப்பதிகம்—
அடலேற அமருங்கொடி அன்ன (பா.எ.360—370)

2. திருநாவுக்கரசர் தேவாரம் : திருவையாற்றுப் பதிகம்
விடகிலேன், அடிநாயேன்; வேண்டியக் கால் யாதொன்றும் (பா.எ.124—133)

3. சுந்தரர் தேவாரம் : திருமழபாடி பதிகம்
பொன் ஆர் மேனியனே! புலித்தோலை அரைக்கு அசைத்து,(பா.எ.1-10 பாடல்கள்) 4. மாணிக்கவாசகர் : திருவாசகம் - பிடித்த பத்து

கூறு: ***2***

நேரம்:18

1. பெரியாழ்வார் : திருமொழி - தாய்ப்பால் உண்ண அழைத்தல் 129—138 வரை 10 பாசுரங்கள்

2. குலசேகர ஆழ்வார்: பெருமாள் திருமொழி- இராமர் தாலாட்டு - 719—729 11 பாசுரங்கள்

3. ஆண்டாள் நாச்சியார்: நாச்சியார் திருமொழி - திருமணக்கனவை உரைத்தல்

4. திருப்பாணாழ்வார் : அமலனாதிபிரான் - 10 பாசுரங்கள்

கூறு: ***3***

நேரம்:18

1. குமரகுருபரர் : வருகைப் பருவம் - 10 பாடல்கள்

2. திரிகூடராசப்பக்கவிராயர் :குற்றாலக் குறவஞ்சி - குறத்தி மலைவளம் கூறல்

3. வீரமாமுனிவர் : தேம்பாவணி - காட்சிப்படலம் முழுவதும்

4. உமறுப்புலவர் : சீறாப்புராணம்-விலாதத்துக் காண்டம்-கதீஜா கனவு கண்ட படலம்

கூறு: ***4*** ***பயன்முறைத்தமிழ்***

நேரம்:18

எழுத்தியல்: உயிரெழுத்து, மெய்யெழுத்து, உயிர்மெய்யெழுத்து,முதலெழுத்து, சார்பெழுத்து, மொழிக்கு முதலாகவும் இறுதியாகவும் வரும்எழுத்துக்கள்,போலி.
சொல்லியல்: இலக்கண, இலக்கிய வகையிலான சொற்கள்.
பொதுவியல் : எழுத்துப் பிழைகளை நீக்குதல்,எழுத்துப் பிழைகளும் திருத்தங்களும்,வலி மிகுதல்,வலிமிகாமை ,வாக்கிய அமைப்புக்கள், நிறுத்தற் குறியீடுகள்.

கூறு;5 இலக்கண இலக்கிய வரலாறு ***நேரம்:18***

1. இலக்கண வரலாறு (தமிழ்த்துறை வெளியீடு)

2. தமிழ் இலக்கிய வரலாறு: இடைக்கால இலக்கியம்

பயன்கள்

1. பல்வகை சமய இலக்கியப் போக்குகளை அறிந்து கொள்வர்.

2.சமயவழித் தமிழரின் வாழ்வியலை அறிவர்.

3. பல்வகை சமயக் கோட்பாட்டினை அறிந்துகொள்வர்.

4. பிழையின்றி எழுதப் பழகுவர்.

5. சமயங்களின் இன்றியமையாமையை உணர்வர்

Semester	Course Code	Title of The Course	Hours of Teaching / Week	No. of Credits
II	**20U2STE2**	**PART – II- Extensive Readers and Communicative Skills**	**6**	**3**

Objective

- **To impart language and communicative skills through short stories, one-act plays and communicative grammar.**

Unit – I

Shakespeare – The Seven Stages of Man
Longfellow – A Psalm of Life
Nissim Ezakiel – Enterprise
William Wordsworth – The world is too much with us

Unit – II

Anton Chekhov - The Bear
Cedric Mount - The Never-Never Nest
Farrell Mitchell - The Case of the Stolen Diamonds
M.V. Rama Sharma - The Mahatma

Unit - III

Fyodor Dostoyevsky - The Christmas Tree and the Wedding
The Duchess - The Jewelry
O. Henry - The Romance of a Busy Broker

Unit – IV

Tense, Question Tag, Dialogue Writing, Paragraph Writing, Adjectives, Adverb

Unit – V

Voices, Degrees of Comparison, Direct and Indirect

Course outcomes

After the completion of this course students will be able to

- **promote the linguistic and communicative objectives through the study of poems, short stories and the communicative grammar.**
- **gain language and communicative skills through short stories**
- **identify and differentiate different forms of literature.**
- **engage in reflective writing after learning the prescribed lessons.**
- **enhance the communicative skills through LSRW**

Prescribed Texts:

- *Voices of Vision*, Board of Editors, NCBH, Chennai, 2016.

Communicative Grammar, The Department of English Course Material.

Semester	Subject Code	Titles of the Paper	Hours of Teaching / Week	No. of Credits
II	**20U2STC3**	**Discrete Distributions**	**5**	**5**

Course Objective:

- To teach basic concepts required for further studies of advanced curriculum.
- To teach probability theory at basic and advance level, random variables and also geometric distribution.
- To teach the concept of discrete and continuous probability distributions.

Unit I: **15 Hrs**

Discrete distribution; Binomial distribution –Definition, concepts and Derivation of moments, moments Generating function, Additive property, Characteristic function and Recurrence relation for moments – simple problems

Unit II: **15 Hrs**

Additive property of Binomial distribution – Characteristic – cumulants recurrence relation for cumulants of Binomial distribution. Probability Generating function of binomial distribution – Recurrence relation for the probabilities of Binomial distribution.

Unit III: **15 Hrs**

Poison distribution – moments , mode , Recurrence relation for moments – M.G.F characteristic function – cumulants , additive property of independent Poisson variable.

Unit IV: **15 Hrs**

Geometric distribution – moments M.G.F – Hyper geometric distribution distribution – mean and variance, M.G.F. Binomial as a limiting from of Hyper – Geometric distribution – multinomial distribution – Definition only.

Unit V: **15 Hrs**

Negative – Binomial distribution – moments M.G.F., cumulants, additive property, recurrence relation for the probabilities.(Simple Problems)

Course Outcomes:

After completion of the course, the student will be able to

- understand how the Bernoulli trials used in real life.
- Promote the rare case population.
- learn the mean and variance of Hyper geometric distribution.
- understand why Geometric distribution possesses memory less property
- explore problem solving skills in competitive exams like combined statistical subordinate service exam (Group –IV).

Books recommended for study:

1. "*Fundamentals of mathematical statistics*" By Gupta, S.C and Kapoor, V.K.,(Sultan chand& sons)
2. "*Introduction to Mathematical Statistics*", Hogg R.V and Craig, A.G., (Amerind.)

Unit I : Chapter 8 : Sec 8.1 to 8.4 to 8.46
Unit II : Chapter 8 : Sec 8.4.7 to 8.4.12
Unit III: Chapter 8 : Sec 8.5
Unit IV: Chapter 8 : Sec 8.7 to 8.9
Unit V : Chapter 8 : Sec 8.6 **General**

References Links:

1. https://www.maths.cam.ac.uk/undergrad/files/coursesIA.pdf[Cambridge]
2. http://collegecatalog.uchicago.edu/search/?P=STAT%2025100[University of Chicago]

Semester	Subject Code	Titles of the Paper	Hours of Teaching / Week	No. of Credits
II	**20U2STCPL1**	**MAJOR PRACTICAL - I DESCRIPTIVE STATISTICS**	**4**	**3**

Course objective

- To impart appropriate data reduction techniques.
- To impart the relationship between the variables/attributes in a given dataset.
- To impart statistical tools for drawing meaningful inferences.

1. Diagrams:Bar diagram – simple – Multiple – Sub-divided bar diagram – percentage bar diagram – pie diagram.
2. Graphs: Histogram - frequency polygon – Frequency curve – ogives curve.
3. Formation of frequency distribution – Discrete and continuous.
4. Measures of central Tendencies: Arithmetic, Mean, median, mode, Geometric mean and Harmonic mean.
5. Measures of Dispersion: Range – Standard Deviation-Mean deviation-Quartile deviation and coefficient of variation.
6. Skewness: Karl Pearson and Bowley'sCoefficie.nt of skewness-kurtosis.
7. Correlation – Karl Pearson and Spearman's rank correlation of coefficients.
8. Regression – Estimation of Regression equations.

Course outcomes:

After completion of the course, the student will be able to

- understand Statistical Methods imparts fundamental ideas about Statistics and research.
- learn the Statistics helps to visualize the next level of analysis.
- Statistical Methods also provides tools to systematically analyse data and draw conclusions for all real-life issues.
- learn the vital tools that are necessary to learn related subjects such as Economics, Commerce, Actuarial, Finance, etc.,
- gain knowledge and do research in various fields of human activities

Note: Students should be given exposure in handling basic statistical data.

Three questions are to be answered out of five question.

Semester	Subject Code	Title of the Paper	Hours of Teaching/ Week	No. of Credits
I & II	**20U2STMAA2**	**Allied Mathematics-II**	**3+3**	**4**

Objectives:

- To introduce the concepts of correlation and regression.
- To teach the concepts of interpolation, numerical solution of ordinary differential equation and multiple integrals.
- To enrich the knowledge of application of multiple integrals.

UNIT –I

Correlation and Regression: Karl Pearson coefficient of correlation – Rank correlation – Regression: Regression coefficients – Properties of regression coefficients

UNIT – II

Interpolation: Gregory Newton forward interpolation formula - Backward interpolation formula- Gauss forward interpolation formula - Backward interpolation formula – Lagrange's interpolation formula ***(no proofs, simple problems only)***.

UNIT – III

Numerical solution of ordinary differential equation: Taylor series – Euler's method – Modified Euler's method – R. K method (4^{th} order only).

UNIT – IV

Beta and Gamma Functions: Definitions – Convergence of $\Gamma(n)$ – Recurrence formula of gamma function – Properties of beta function – relation between beta and gamma functions - Problems.

UNIT – V

Multiple integral: Double integral – Evaluation of double integral - change of order of integration – Polar coordinates - Triple integrals - Application of multiple integrals.

Course Outcomes:

After completion of the course, student will be able to,

- give information on the strength and direction of the linear relationship between two variables using correlation.
- find numerical approximations to the solutions of ODE.
- calculate the area of a region, the volume under a surface and the average values of a function of two variables.
- know the relation between beta and gamma function.
- distinguish the overall mathematical knowledge gained to demonstrate and analyze the problems in real life situation.

Text Book:

4. ***Fundamentals of Mathematical Statistics,*** *S.C. Gupta, V. K. Kapoor, Sulthan, 2002.*
   Unit I: Chapter – 10(Sec.10.2–10.4, 10.7), Chapter – 11(Sec.11.1–11.2.2)
5. ***Numerical methods****, P. Kandasamy, Thilagavathi and Gunavathi*
   Unit II: Chapter: 6 (6.1-6.3), Pages: 209 – 225, Chapter: 7 (7.1-7.4), Pages: 231 – 240, Chapter: 8 (8.7 only), Pages: 271 - 276.
   Unit III: Chapter – 11(Sec.11.5, 11.9, 11.11 – 11.3), Pages:352 – 358,369 -389
6. ***Calculus Vol II :*** *T.K. M. Pillai, 2015*
   Unit IV: Chapter 7 (Sec: 2 – 5)
   Unit V : Chapter 5 (Sec: 2 – 5.3)

General References:

1. Statistics - M. Sivathanupillai
2. Ancillary Maths - P.R.,Vittal, Margam Publications.

B.Sc. (Statistics)

Semester	Subject Code	Title of the Paper	Hours of Teaching/ Week	No. of Credits
II	**20U2STMAA3**	**Allied Mathematics- III**	**5**	**3**

OBJECTIVES:

- To introduce various methods to solve the partial differential solution.
- To teach the concept of curl & divergence of vector field.
- To introduce the concept of laplace transforms and fourier series.

Unit – I Partial Differential Equation:

Derivation of partial differential equation – Different integrals of PDE – standard types of first order equations of the form f (p, q) = o; f (x, p, q) = 0; f(y, p, q)= 0; f(z, p, q) = 0; $f_1(x, p) = f_2(Y, q)$; z = p x + qy + f(p, q) – Lagrange's method for solving $P_p+Q_q=R$.

Unit – II Vector differentiation:

Vector differential operator – Gradient – Direction and magnitude of gradient – Divergence and curl – Formulae involving operator ∇.

Unit –III Vector integration:

Gauss Divergence theorem – Stoke's theorem (no proof of the theorem).

Unit – IV Laplace Transforms:

Definition – Results and proofs: Laplace Transform of functions f(t) + g(t), cf(t), f'(t), f" (t), e^{at}, coshat, sinhat, cosat, sinat, t^n - some general theorems – Inverse transforms relating to the above standard forms - solution of ordinary differential equation with constant coefficients.

Unit – V Fourier Series:

Definition – finding Fourier coefficients for the given periodic function with period 2π - Even and odd functions – Properties of odd and even functions - Half range Fourier series – Development in Cosine and sine series.

COURSE OUTCOME:

After completion of the course, the students will be able to

- Solve partial differential equation of both first and second order.
- use Stoke's theorem to give a physical interpretation of the curl of a vector field.
- use Green's theorem to evaluate line integral along simple closed contours on the plane.
- gain knowledge about basic concept of laplace transforms, vector differentiation and vector integration.
- understand the properties of fourier series.

Text Book:

Ancillary Mathematics, Volume-II, *S. Narayanan, R. Hanumantha Rao, T.K.Manicavachagom Pillay, S. Viswanathan Printers Pvt. Ltd., 2015.*

Unit I : Chapter 5, Sec: 1 – 3, 5, 6 (Pages: 252 – 257, 262 – 273)
Unit II : Chapter 8, Sec: 16 – 21 (Pages: 335 – 357)
Unit III: Chapter 8, Sec: 6, 9 (Pages: 381 – 389, 399 – 407)
Unit IV: Chapter 7, Sec: 1 – 6 (Pages: 289 – 310)
Unit V : Chapter 2, Sec: 1 – 5 (Pages: 123 – 148)

General References:

1. *Engineering Mathematics – A Singaravelu(Volume I & II)*
2. *Vector Calculus – K.Viswanbathan and S.Selvaraj.*
3. *Ancillary Mathematics – P.R.Vittal, Margam Publications.*

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Semester	Subject Code	Titles of the Paper	Hours of Teaching / Week	No. of Credits
II	**20U2STS1**	**SKILL BASED EDUCATION – I** **Verbal Reasoning – I**	**1**	**1**

Course Objectives

- To acquaint them with frequently asked patterns in quantitative aptitude and logical reasoning during various examinations and campus interviews.
- To demonstrate various principles involved in solving mathematical problems and thereby reducing the time taken for performing job functions.
- To impart aptitude training is to make students able to critically evaluate various real-life situations by resorting to an analysis of key issues and factors

Unit I: **8 Hrs**

Series completion- Number series - Alphabetic series, Coding and decoding- Letter coding- Number coding and Blood Relations- Deciphering jumbled up descriptions- Relation puzzle.

Unit II: **7 Hrs**

Puzzle Test- Seating/ Placing arrangements- Comparison test and Logical Venn diagram.

Text Book:

"A modern approach to verbal reasoning" - R.S. Aggarawal, S.Chand and company Ltd., New Delhi- 55

Unit I : Chapter 1 (1-21); Chapter 4 (194-210); Chapter 5 (261-276).

Unit II : Chapter 6 (Page 288 to 296,) (307-310) (328-33

Chapters 9 (441-449).

Course outcomes:

After completion of the course, the student will be able to

- understand the basic concepts of quantitative ability.
- understand the basic concepts of logical reasoning Skills.
- Enhance different placement practice techniques.
- solve campus placements aptitude papers covering Quantitative Ability, Logical Reasoning ability.
- compete in various competitive exams like CAT, CMAT, GATE, GRE, GATE, UPSC, GPSC etc.

Semester	Subject Code	Title Of The Paper	Hours Of Teaching / Week	No. of Credits
III	**20U3STT3**	**காப்பியங்கள், கட்டுரைகள், இலக்கிய வரலாறு**	**6**	**3**

நோக்கம்

1. காப்பியங்களின் உள்ளடக்கம், உத்திகளைக் கற்றுக்கொடுத்தல்.

2. காலந்தோறும் காப்பியங்களில் காணலாகும் பாடுபொருள்களின் மாற்றங்களை எடுத்துரைத்தல்.

3. காப்பியச்சுவையை மாணவர்கள் அறிந்து கொள்ளச் செய்தல்.

கூறு:1 காப்பியங்கள் ***நேரம்:18***

1. சிலப்பதிகாரம்: மதுரைக்காண்டம்-வழக்குரைகாதை
2. மணிமேகலை; மலர்வனம் புக்ககாதை
3. சீவக சிந்தாமணி: சுரமஞ்சரியார் இலம்பகம்
4. கம்பராமாயணம்: கங்கைப் படலம்

கூறு:2காப்பியங்கள் ***நேரம்:18***

1. பெரியபுராணம் : மெய்ப்பொருள் நாயனார் புராணம்-முழுவதும்
2. அரிச்சந்திரபுராணம்: மயான காண்டம்
3. தேம்பாவணி: திருமணப் படலம்-1-10 பாடல்கள்
4. சீறாப்புராணம் : நபி அவதாரப் படலம்-1-10 பாடல்கள்

கூறு: 3 கட்டுரைத் தொகுப்புகள் ***நேரம்:18***

1. கேட்டிவி - இராகபாவம் (1-10)
2. கேட்டிவி - பயணங்கள் தொடரும்

கூறு:4 கட்டுரைக் கடிதங்கள் மொழிபெயர்ப்புப் பயிற்சிகள் ***நேரம்:18***

பயிற்சிக்கட்டுரைகளும் கடிதங்களும் -பாவை வெளியீடு
கட்டுரைப் பயிற்சி - 10 மதிப்பெண்கள்
மொழிபெயர்ப்புப் பயிற்சி - 5 மதிப்பெண்கள்

கூறு:5 இலக்கிய வரலாறு ***நேரம்:18***

காப்பிய இலக்கியங்கள் - சிற்றிலக்கியங்கள்

பயன்கள்

1. காப்பியங்கள் வாயிலாக அக்காலச் சமுதாயச் சூழலை அறிவர்.
2. பல்வேறு காப்பியங்களையும் ஒப்பிட்டு அவற்றின் தனித்தன்மைகளை அறிந்துகொள்வர்.
3. மீட்டுருவாக்கச் சிந்தனைகளை அறிவர்.
4. கட்டுரை எழுதும் திறன் பெறுவர்.
5. கடிதங்கள் எழுதும் பயிற்சி பெறுவர்.

Semester	Course Code	Title of The Course	Hours of Teaching /Week	No. of Credits
III	**20U3STE3**	**PART - II Shakespeare, Extensive Readers And Communicative Skills**	**6**	**3**

Objective

- **To introduce the language and creativity of the world-renowned dramatists and novelists to enhance the communicative skills of the learners.**

Unit – I

Julius Caesar
The Merchant of Venice

Unit – II

Macbeth
Twelfth Night

Unit – III

Romeo and Juliet
Tempest

Unit – IV

Thomas Hardy – The Mayor of Casterbridge

Unit – V

Note making, Hints Developing, Expansion of Ideas and Proverbs, Clauses and Sentence, Structure: Simple, Compound and Complex.

Course outcomes

After the completion of this course students will be able to

- **promote their communicative skills through the study of Shakespeare and modern communicative methods.**
- **expand their perception interacting with the culture across the world**
- **imbibe moral and ethical prescriptions**
- **appreciate the creative genius and affluent expressions of Shakespeare**
- **develop the creative and analytical faculty**

Prescribed Texts:

Natarajan, K.ed. *Selected Scenes from Shakespeare*. Chennai: NCBH, 2017.

Hardy, Thomas.*The Mayor of CasterBridge*.(abridged)Chennai: Macmillan Publishers,2012.

Communicative Grammar.Department of English Edition. 2017

Semester	Subject Code	Titles of the Paper	Hours of Teaching / Week	No. of Credits
III	**20U3STC4**	**CONTINUOUS DISTRIBUTIONS**	**5**	**5**

Course Objective:

- To teach the nature of variables measured in a continuum and ways of handling the same.
- To impart of quantifying uncertainty associated with continuous variables in terms of continuous distributions.
- To learn the methods of obtaining summarizing measures of continuous distributions.
- To impart a given situation with a continuous probability law towards drawing conclusions in an environment of uncertainty

Unitt – I

Normal distribution – limiting form of Binomial distribution , properties , median, mode and moments **15 Hrs**

Unit – II **15 Hrs**

Normal distribution - M.G.F , cumulants , mean deviation , area property , simple problems – Rectangular distribution – moments . M.G.F , characteristic function, mean deviation.

Unit – III **15 Hrs**

Gamma , Beta distribution of Ist kind and IInd kind – constants – exponential distributions – additive property.

Unit – IV **15 Hrs**

Weibul distribution –moments, characteristic logistic distribution – moment, Cauchy distribution – Characteristic function –moments of Cauchy distribution.

Unit – V **15 Hrs**

Funtion of normal random variable to chi-square , t and F – distributions –inter relationship between the distributions and their properties.

Course outcomes:

After completion of the course, the student will be able to

- analyse normal and other distributions, employ calculus methods and establish properties of distributions.
- discover and Discuss the properties of normal and other distributions, analyze the characteristics and deduce the distributions of transformed variables.
- understand various distributions as models for relevant situations, recognize and relate sample statistics to different distributions and compute the chances of occurrences of events concerning continuous variables
- summarize the roles of different distributions in practical situations and illustrate with examples the nature of limiting distributions for large samples
- explore problem solving skills in competitive exams like combined statistical subordinate service exam (Group –IV).

Reference Books:

1. Fundamentals of Mathematical Statistics - S.C.Gupta, V.K.Kapoor.

Unit I : Chapter 6 : Sec 6.11 , 6.13, 6.14, 6.15
Unit II : Chapter 9 : Sec 9.2 to 9.3
Unit III : Chapter 9 : Sec 9.5 to 9.7
Unit IV : Chapter 9 : Sec 9.10 to 9.12
Unit V : Chapter 15,16 : Sec 15.3 , 16.2 , 16.5

General References Links:

1. http://www.tezu.ernet.in/dmaths/programme/PhD-MathSc-syllabus_2013.pdf[Oxford University]
2. http://collegecatalog.uchicago.edu/search/?P=STAT%2024400 [University of Chicago]
3. https://courses.maths.ox.ac.uk/node/43890[Oxford]

Semester	Subject Code	Titles of the Paper	Hours of Teaching / Week	No. of Credits
III	**20U3STC5**	**STATISTICAL INFERENCE – I Theory of Estimation**	**5**	**5**

Course Objective:

- To describe many of the important estimation methods and characteristics of the estimators
- To teach the problem of statistical inference with specific reference to point estimation
- To impart deeper insight for constructing optimal estimators and tests.

Unittt I: **15 Hrs**

Concept of Statistical Inference- Parametric estimation- Sampling distribution – Standard Error. Derivation of Standard Error of mean, variance, proportion, difference between means, variances and Proportions-Simple Problems

Unit II: **15 Hrs**

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

Unit III: **15 Hrs**

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 IV: **15 Hrs**

Interval Estimation: Fiducial limits-derivation of confidence intervals based on Normal t, chi-square and F distributions. Confidence intervals- using Cramer – Rao inequality.

Unit V: **15 Hrs**

Partial and multiple correlation and regression coefficients – Simple problems.

Course Outcomes:

After completion of the course, the student will be able to

- understand Infinite populations, Parameters and Estimators
- learn methods of improving the estimates
- Identify conditions for deriving optimal estimates; Draw Inference in the best possible manner.
- learn different methods to draw inference about unknown parameters to best suit for the real time data.
- explore problem solving skills in competitive exams like combined statistical subordinate service exam (Group –IV).

Text Book:

1.Fundamentals of Mathematical statistics by S.C. Gupta &V.K.Kapoor

Unit I : Chapter 14,9 : Sec14.1 – 14.8
Unit II : Chapter 17 : Sec 17.1- 17.3,17.5
Unit III: Chapter 17 : Sec 17.6
Unit IV: Chapter 17,12 : Sec 17.7 & 12.4 – 12.11
Unit V : Chapter 12: Sec12.4 ,12.7 ,12.8 &Problems 12.7 -12.15

General References Links:

1. http://collegecatalog.uchicago.edu/search/?P=STAT%2020000[University of Chicago]
2. https://www.imperial.ac.uk/engineering/departments/civilengineering/prospective-students/undergraduate-[Imperial college London]

Semester	Subject Code	Titles of the Paper	Hours of Teaching / Week	No. of Credits
III	**20U3STCSA1**	**Allied Computer Programming in C**	**5**	**3**

Course Objectives:

- To teach the techniques of C- Programming
- To impart the numerical problems using C
- To impart decision making and branching

Unit I **15 Hrs**

Constants, variables and Data Types- Operators and Expressions- Input and Output Operators.

Unit II **15 Hrs**

Decision Making and Branching- Decision Making and Looping.

Unit III **15 Hrs**

Arrays- handling of Character Strings.

Unit IV **15 Hrs**

User Defined functions.

Unit V **15 Hrs**

Structures and Unions.

Course outcomes: After completion of the course, the student will be able to

- understand the basic concepts of C Programming for problem-solving
- illustrate the C data types, syntax and constructs.
- illustrate C for decision making, branching and looping statements.
- promote the concept of Array and Strings to solve different problems
- apply the concepts of Function modules, its usage and memory allocation using Pointers
- understand the concepts of structures and unions: declaration, initialization and implementation

Text Book:

"Programming in Ansi C" byE.Balagurusamy; Second Edition, 1992, Tata McGraw- Hill Publishing Company Limited, New Delhi.

Unit I : Chapters 2, 3 & 4

Unit II : Chapter 5 & 6

Unit III : Chapter 7 & 8

Unit IV : Chapter 9

Unit V : Chapter 10

Semester	Subject Code	Titles of the Paper	Hours of Teaching / Week	No. of Credits
III &IV	**20U4STCSAPL**	**Allied Computer Practical (NS)**	**3**	**2**

Programs for the following problems only
(For both theory and practical)

Programs

1. Pay bill calculation
2. Mark list
3. Ascending and descending orders
4. Test for palindrome word
5. (a). Mean, Standard deviation and coefficient of variation for raw data

   (b). Sorting a list and find its Median
6. Coefficient of correlation and regression equations
7. Matrix multiplication
8. Lagrange's interpolation
9. Range-kutta method (IV Order)
10. Trapezoidal rule and simpson rule

Reference

Chapter 2 to 7,
Chapter 8 (8.1, 8.2 & 8.8),
Chapter 9 (9.4 to 9.5),
Chapter 10,
Chapter 11 (11.1 to 11.8),
Chapter 12 (12.1 to 12.4, 12.6) –
Treatment as in

'*Programming in ANSI C*' by E.Balagurusamy, Second Edition, 1992. Tata McGraw Hill Publishing Company Limited, New Delhi.

Semester	Subject Code	Title Of The Paper	Hours Of Teaching/ Week	No. of Credits
IV	**20U4STT4**	**சங்க இலக்கியம் – அற இலக்கியம் – செம்மொழி தமிழ்– இலக்கிய வரலாறு**	**6**	**3**

நோக்கம்:

1.பழந்தமிழ் இலக்கியங்களின் திணைத்துறைக் கோட்பாடுகளை அறிதல்.
2.திணைசார் சமுதாய வாழ்வின் பல்வேறுபட்டப் பரிமாணங்களைப்
3.புலவர்கள் வாயிலாகவும் திணை இலக்கியத்தின் வாயிலாகவும் அறிதல்.
4.பழந்தமிழ் இலக்கியங்களின் உயர்தனித்தன்மை வாய்ந்த சிறப்பியல்புகளை அறிதல்.

கூறு: 1 எட்டுத்தொகை ***நேரம்:18***

குறுந்தொகை

1.குறிஞ்சி : தலைவன் கூற்று-யாயும் ஞாயும் யாராகியரோ - பா.எ.-40
2.முல்லை : தலைவி கூற்று-கருங்கால் வேம்பின் ஒண்பூ யாணர் - பா.எ.-24
3.மருதம் : தோழி கூற்று-யாய் ஆகியளே விழவு முதலாட்டி - பா.எ.-10
4.நெய்தல் : தலைவி கூற்று :நள்ளன் றன்றே யாமம் - பா.எ.-6
5.பாலை: செவிலி கூற்று-பறைபடப் பணிலம் - பா.எ.-15

நற்றிணை

1. குறிஞ்சி-நின்ற சொல்லர் பா.எ. 1
2. முல்லை:இறையும் அருந்தொழில் -பா.எ.161
3. மருதம்:அறியாமையின் அன்னை - பா.எ.50
4. நெய்தல்:இவளே கானல் நண்ணிய - பா.எ.45
5. பாலை:புணரில் புணராது பொருளே-பா.எ.16

கலித்தொகை

1. பாலை: எறித்தரு கதிர் தாங்கி- பா.எ.9
2. குறிஞ்சி : காமர் கடும்புனல்- பா.எ.39

அகநானூறு

1. குறிஞ்சி:நீர்நிறம் கரப்ப-பா.எ.18
2. முல்லை: வந்துவினை- பா.எ.44

கூறு: 2 எட்டுத்தொகை ***நேரம்:18***

1. ஐங்குறுநூறு : குறிஞ்சி -அன்னாய் வாழிப்பத்து -பா.எ.201-210
2. புறநானூறு : பாடல் எண்கள் - 9,16,20,51,109
3. பதிற்றுப்பத்து:ஆறாம் பத்து-
பா.எ.1 வடுவடு நுண்ணுயிர், பா.எ.2.கொடி நுடங்கு நிலைய
4. பரிபாடல் : ஏழாம்பாடல் - வையை

கூறு: 3 பத்துப்பாட்டு ***நேரம்:18***

1. குறிஞ்சிப்பாட்டு: முழுவதும்

கூறு: 4 அறநூல்கள் ***நேரம்:18***

1. திருக்குறள்: செய்ந்நன்றியறிதல் ,வினைத்திட்பம்,நெஞ்சொடு கிளத்தல்

2. மூதுரை: 1-10 பாடல்கள்

3.நல்வழி: 11-20 பாடல்கள்

4.நீதிநெறி விளக்கம்: 51-60 பாடல்கள்

கூறு: ***5***

நேரம்:18

அ. செம்மொழித் தமிழ்— இலக்கிய வரலாறு :

செம்மொழி வரலாறு : மொழி விளக்கம்-மொழிக்குடும்பங்கள்-உலகச் செம்மொழிகள் -இந்தியச் செம்மொழிகள் — செம்மொழித் தகுதிகள் - வரையறைகள் - தமிழின் தொன்மை -தமிழ்ச் செம்மொழி நூல்கள்.

ஆ. இலக்கிய வரலாறு: சங்க இலக்கியங்கள் ,பதினெண் கீழ்க்கணக்கு நூல்கள்

பயன்கள்

1.பழந்தமிழ் இலக்கியங்களை ஆய்வியல் நோக்கில் அணுகுவதற்கான வழிமுறைகளை உணர்த்துதல்.

2.பண்டைத்தமிழரின் அக, புற வாழ்வியலை மாணவர்கள் அறியச் செய்தல்

3.அறத்தின் பெருமையை உணர்வர்

4.ஒழுக்க நெறிகளைப் பின்பற்றுவர்

5.தமிழ் செம்மொழியின் பண்புகளை உணருதல்

6.சங்க இலக்கியத்தின் தொன்மை உணர்தல்

Semester	Course Code	Title of The Course	Hours of Teaching / Week	No. of Credits
IV	**20U4STE4**	**PART - II English For Competitive Examinations**	**6**	**3**

Objective

- **To prepare the learners for competitive examinations and to teach the fundamentals of practical communication.**

Unit – I

Grammar – Number, Subject, Verb, Agreement, Articles, Sequence of Tenses, Common Errors

Unit – II

Word Power - Idioms & Phrases, one-word substitutes, Synonyms, Antonyms, Words we often confuse, foreign words & phrases, spelling.

Unit – III

Reading & Reasoning – Comprehension, Jumbled Sentences.

Unit – IV

Writing Skills – Paragraph, Précis Writing, Expansion of an idea, Report Writing, Essay, Letters, Reviews (Film & Book)

Unit – V

Speaking- Public speaking, Group Discussion, Interview, Spoken English.

Course outcomes

After the completion of this course students will be able to

- **develop English language skills by equipping themselves to face competitive exams**
- **improve English language abilities and gain the skills of writing and vocabulary building**
- **gain confidence to face competitive exams**
- **assimilate grammatical rule clearly and precisely**
- **hone their presentation and public speaking skills**

Prescribed Text:

English for Competitive Examinations, NCBH, Chennai, Dec. 2019.

Semester	Subject Code	Titles of the Paper	Hours of Teaching / Week	No. of Credits
IV	**20U4STC6**	**STATISTICAL INFERENCE – II Testing of Hypothesis**	**5**	**5**

Course Objectives:

- To teach the concepts of hypothesis testing.
- To explain differentiate between large and small samples and apply apt testing procedures.
- To explain various non-parametric tests and its applications.
- To explain the concepts with various numerical examples.

Unit-I: **15 Hrs**

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 and its applications

Unit-II: **15 Hrs**

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

Unit –III: **15Hrs**

Test of significance –Asymptotic and exact tests based on, *t*, and *F* distributions with regard to mean, proportion, variance, Standard deviation, coefficient of correlation.

Unit-IV: **15 Hrs**

Contingency table –Test for independence by contingency tables –goodness of fitness tests –tests of homogeneity of variances.

UNIT-V: **15 Hrs**

Elementary ideas on non-parametric tests, Advantages and Disadvantages –Run, Median, Sign and Mann Whitney tests (without proof).

Course outcomes:

After completion of the course, the student will be able to

- know the role of Neyman – Pearson Lemma in testing of hypothesis.
- learn the properties of Like likelihood ratio test.
- upgrade the test of significance for small samples..
- learn the problems using non parametric tests.
- learn the role of Non parametric tests.
- explore problem solving skills in competitive exams like combined statistical subordinate service exam (Group –IV).

Text Book:

1.*Fundamentals of Mathematical statistics* by Guptha S.C and Kapoor V.K
(Sulthanchand& sons)

Unit I : Chapter 18 : Sec 18.1 -18.3 ,18.5
Unit II : Chapter 18 : Sec 18.4,18.6
Unit III : Chapter 16 : Sec 16.3,16.6
Unit IV : Chapter 15 : Sec 15.6
Unit V : Chapter 18 : Sec 18.7

General References Links:

1. https://www.imperial.ac.uk/engineering/departments/civilengineering/prospective-students/undergraduate-admissions/syllabus/
   [Imperial college London]
2. https://www.umu.se/en/education/courses/statistics-for-engineers/
   [Umea University, Sweden]

Semester	Subject Code	Titles of the Paper	Hours of Teaching / Week	No. of Credits
IV	**20U4STC7**	**SAMPLING TECHNIQUES**	**4**	**4**

Course Objectives:

- To impart basic concepts in Sampling Theory.
- To prepare students in conducting sample surveys.
- To explore various sampling techniques and understand their merits and drawbacks.
- To provide appropriate estimates of the required summary measures of large Populations

Unit-I: 15 Hrs

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-II: 15 Hrs

Stratified sampling, Equal, proportional, Neymann 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-III: 15 Hrs

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

Unit-IV: 15 Hrs

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-V: .(Self Study)

Design, organization and execution of sample surveys –sampling and nonsampling errors and methods to deal with sampling errors.

Course outcomes:

After completion of the course, the student will be able to

- understand the principles and principal steps of sampling, and different sampling techniques.
- apply different sampling techniques to take samples and compute unbiased estimates and confidence limits of population parameters.
- analyse the unbiasedness and efficiencies of estimates obtained using different sampling techniques
- develop a questionnaire, organize a sample survey by implementing different sampling techniques and predict population characteristics.

Text Book:

Fundamental of Applied Statistics By S.C Gupta and V.K Kapoor

References :

1. Sampling Techniques by Cochran, W.G (Wiley Est)
2. Sampling theory of survey with applications by Sukathme P.V and sukathme B.V (Asia pub.House)
3. Sampling theory and Methods by Murthy, M.N (Statistical publishing

Unit I : Chapter 7 : Sec 7.9 to 7.9.6
Unit II : Chapter 7 : Sec 7.10 to 7.10.4
Unit III: Chapter 7 : Sec 7.11 to 7.11.4
Unit IV: Chapter 7 : Sec 7.12, 10.1 to 10.4
Unit V : Chapter 7 : Sec 7.1 to 7.9

General ReferenceLinks:

1. https://www.southampton.ac.uk/courses/modules/stat6086.page#syllabus [University of Southampton]
2. https://mathstat.uoguelph.ca/sites/default/files/STAT3320%20Course%20Outline.pdf[University of Guelph]

Semester	Subject Code	Titles of the Paper	Hours of Teaching / Week	No. of Credits
IV	**20U4STCSA2**	**ALLIED DATA MINING**	**5**	**3**

Course Objective:

- To know about the architecture and concepts of data warehousing and mining.
- To demonstrate and implement classical models and algorithms in data warehouses and data mining
- To explain skill in selecting the appropriate data mining algorithm for solving practical problems.
- To teach Master data mining techniques in various applications like social, scientific and environmental context.

UNIT I: 15Hrs

Introduction – data mining – data mining functionalities – classification of data mining systems – data mining task primitives – integration of a data mining system with a database or data warehouse system – descriptive data summarization.

UNIT II: 15 Hrs

Data processing – data cleaning – data integration and transformation – data reduction – data discretization and concept of hierarchy generation – data ware housing and OLAP technology – a multidimensional data model – data warehouse architecture.

UNIT III: 15 Hrs

Classification and prediction – what is classification?-What is prediction? – Issues regarding classification and prediction – Bayesian classification.

UNIT IV: 15 Hrs

Cluster analysis – types of cluster analysis partitioning methods – Hierarchial methods – Density based methods.

UNIT V: 15 Hrs

Applications and trends in data mining – data mining application, social impacts of data mining – trends in data mining – data mining system products and research prototypes.

Course outcomes:
After completion of the course , student will be able to

- learn new, advanced techniques for emerging applications.
- gain practical intuition about how to apply these techniques on datasets of realistic sizes using modern data analysis frameworks.
- understand the functionality of the various data mining and data warehousing component
- learn the different methodologies used in data mining and data ware housing.
- understand the strengths and limitations of various data mining and data warehousing models

References:

1. "Data mining concepts and techniques", Jiawei Han and MichelineKamber, second edition, Morgam Kaufman Publications – 2006
2. "Data warehousing in the real world", Sam Anahory and Dennis Murray, Addition Wesely, Pearson Education Asia Pvt. Ltd – 2000

Semester	Subject Code	Titles of the Paper	Hours of Teaching / Week	No. of Credits
III &IV	**20U4STCSAPL**	**Allied Computer Practical (NS)**	**3**	**2**

Programs for the following problems only
(For both theory and practical)

Programs

11. Pay bill calculation
12. Mark list
13. Ascending and descending orders
14. Test for palindrome word
15. (a). Mean, Standard deviation and coefficient of variation for raw data

    (b). Sorting a list and find its Median
16. Coefficient of correlation and regression equations
17. Matrix multiplication
18. Lagrange's interpolation
19. Range-kutta method (IV Order)
20. Trapezoidal rule and simpson rule

Reference

Chapter 2 to 7,
Chapter 8 (8.1, 8.2 & 8.8),
Chapter 9 (9.4 to 9.5),
Chapter 10,
Chapter 11 (11.1 to 11.8),
Chapter 12 (12.1 to 12.4, 12.6) –
Treatment as in

'*Programming in ANSI C*' by E.Balagurusamy, Second Edition, 1992. Tata McGraw Hill Publishing Company Limited, New Delhi.

Semester	Subject Code	Titles of the Paper	Hours of Teaching / Week	No. of Credits
IV	**20U4STS2**	**SKILL BASED EDUCATION – II Verbal Reasoning- II**	**1**	**1**

Course objective:

- To acquaint the concept of arithmetical reasoning
- To acquaint and manipulate the appropriate time sequence test
- To impart the knowledge of data sufficiency

Unit I:

Number, Ranking and Time sequence test and Mathematical operations- Problem solving by substitution- interchange of signs and numbers.

Unit II:

Arithmetical reasoning, inserting the missing character and Data sufficiency.

Course outcomes:

After completion of the course, the student will be able to

- understand the importance of mathematical operation
- understand the concepts of missing character and data sufficiency
- get more mark in the TNPSC examinations and bank examinations
- apply the solving multiple choice questions.
- prepare and crack the competitive examinations.

Text Book:

"A modern approach to verbal reasoning" - R.S. Aggarawal, S.Chand and company Ltd., New Delhi- 55

Unit I: Chapter 12 (542-550); Chapter 13 (569-579).

Unit II: Chapter 15 (Page 601 to 609); Chapters 16 (Page 628 to 640)

Chapter 17 (654-662).

Semester	Subject Code	Title of the paper	Hours of Teaching /Week	No. of Credits
V	**20U5STC8**	**STOCHASTIC PROCESSES**	**5**	**6**

Course Objective

- To teach the concept of Stochastic process and its types.
- To teach the transition probabilities of one-step and n-step and ChapmanKolmogorov equation.
- To impart the limiting probabilities and find stationary distribution.
- To derive the distribution of Poisson process, Birth process, Birth-Death process

Unit-I **18 Hrs**

Random Variable and Stochastic Processes: - Introduction to Stochastic Processes- Classifications of S.P. Discrete and countable states – Generating functions - Laplace Transform – komogrov equations.

Unit – II **18**

HrsMarkovChains: Definition and Examples-Higher Transition Probabilities. Generalisation of Independent Bernoulli Trials:Sequence of Chain- Dependent Trials

Unit –III **18 Hrs**

Markov Chain:Classification of States and Chains - Determination of Higher Transition Probabilities-Stability of a Markov System

Unit – IV **18 Hrs**

Markov Processes with Discrete State Space:Poisson Process and Extensions: Poisson Process– Poisson Process and Related Distribution.

Unit – V **18 Hrs**

Markov Processes with Discrete State Space:Poisson Process and Extensions:Generalisations of Poisson Process– Birth and Death Process

Course outcomes:

After completing the course, student will be able to

- apply Stochastic Processes deals with mathematical models of systems and phenomena that appear to vary in a random manner.
- utilize classification and types of stochastic processes.
- emphasize on Markov process and its applications.
- learn Discrete time Markov chains involving Transition probability matrix,Limiting probabilities and Stationary distributions are found.
- learn Birth and Death process, Renewal process , Branching process and their properties

Text Book:-

STOCHASTIC PROCESSES Forth Edition– J. MEDHI *-New Age International Publishers, 2015*

Unit I	:	Chapters 1.1 to 1.2 and 1.5 Pages(1-19 and 49-51)
Unit II	:	Chapters 2.1 to 2.3 Pages(62-78)
Unit III	:	Chapters 2.4 to 2.6 Pages(78-99)
Unit IV	:	Chapters 3.1 to 3.2 Pages(138-155)
Unit V	:	Chapters 3.3 to 3.4 Pages(155-170)

General References

1. First course in Stochastic process by Samuel karlin.
2. Stochastic process by Srinivasan and Menta.

General References Links:

1. https://mast.queensu.ca/~stat455/syllabus/syllabus.pdf [Queen's University, Canada]
2. https://ocw.mit.edu/courses/mathematics/18-445-introduction-to-stochasticprocesses-spring-2015/syllabus/[Massachusetts Institute of Technology, USA]

Semester	Subject Code	Titles of the Paper	Hours of Teaching / Week	No. of Credits
V	**20U5STC9**	**Statistical Quality Control**	**5**	**6**

Course Objectives

- To demonstrate the quality improvement using statistical methods and Total Quality Management tools.
- To explore knowledge on process quality through data visualization.
- To implement Process Control using variable and attribute control charts.

Unit – I: **19 Hrs**

Introduction to SQC- Chance and Assignable Causes of Variation- Uses of SQC- Process and Product Control-Control chart for Variables-X-Bar and RChartRevised Control Charts

Unit II: **19 Hrs**

Control Chart for Attributes- Control Chart for Fraction Defective (pChart)- Control Chart for Number of Defectives(d-chart,for fixed and variable sample size)- Control Chart for Number of Defectives per unit (c-Chart)- Natural Tolerance Limit and Specification Limits

Unit III: **19 Hrs**

Acceptance sampling by Attributes- Acceptance Quality Level (A.Q.L)- Lot Tolerance Proportion or Percent Defective(LTPD)-Process Average Fraction Defective(p)- Consumers Risk(β)- Producers Risk(α)-Rectifying Inspection Plan-Average Outgoing Quality Level(AOQL)

Unit IV: **18 Hrs**

Operating Characteristic Curve (OC-curve)-Average Sample Number(ASN) -Average Amount of Total Inspection (ATI)-Single Sampling Plan- Determination of n and c AOQL, OC-curve-Double Sampling Plan- ASN and ATI of Double Sampling Plan- Single sampling Vs Double Sampling plan

Unit V: **(Self Study)**

Sequential Sampling- Sequential Probability Ratio Test (SPRT)-ASN Function of Sequential Sampling Plan **Books for study:**

Gupta, S.C. &Kapoor, V.K(2014), Fundamentals of Applied Statistics, 4th Edition, Sultan Chand&Sons,New Delhi.

Course outcomes:

After completion of the course, the student will be able to

- understand modern business environment and Statistical and Philosophical thoughts for quality improvement.
- identify process variation through data visualization techniques.
- apply various control charts to diagnose and improve process quality
- understand the Cumulative sum control chart, Slant control chart and Process capability Analysis.
- promote the concepts of acceptance sampling plan in quality assurance.

Book for Reference: Mahajan,M., Statistical Quality Control, DhanpatRai& Co.

General ReferenceLinks:

1. https://engineering.purdue.edu/online/courses/stat-quality-control[Purdue University, USA]
2. https://www.csudh.edu/qa-ms/[California State University, USA]

Semester	Subject Code	Titles of the Paper	Hours of Teaching / Week	No. of Credits
V	**20U5STC10**	**DESIGN OF EXPERIMENTS**	**4**	**5**

Course Objectives

- To explain the basic terminology in experimental design.
- To develop the students ability to plan an experiment.
- To obtaining relevant information from the experiment in relation to the statisticalhypothesis under study
- To develop the skill of identifying important inputs that impact the output.

Unit-I: **15 Hrs**

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

Unit-II: **15 Hrs**

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

Unit-III: **15 Hrs**

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

Unit-IV: **15 Hrs**

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

Unit-V: **(Self Study)**

Factorial designs -22,23and 32 factorial designs with and without confounding.

Course outcomes:

After completion of the course, the student will be able to

- understand the basic concepts and principles of experimental designs and recall the concept of estimation theory and testing of hypothesis.
- identify the factors and variable for the experiment for building statistical model.
- Analyze the various design of experiment concepts and missing plot techniques.
- understand the ANOVA results interpret the key variables that influence the response variables.
- understand suitable designed experiment for a given real life data

Text Book:

Fundamentals of Applied Statistics by S.C Gupta and V.K Kapoor

References ;

1. Statistical theory in research by Anderson RL and Bangrtt TA (McGraw HILL)
2. The design of Analysis of Experiments by Kempthrone,B (Wiley Eastern)
3. Design and Analysis of Experiments by Das, M.N., and Giri, N.L (wiley Eastern)

Unit I : Chapter 5 : Sec 5.1 -5.3
Unit II: Chapter 6: Sec 6.1 -6.3
Unit III: Chapter 6 : Sec 6.4 – 6.6
Unit IV:Chapter 6 : Sec 6.7- 6.8
Unit V : Chapter 6 : Sec 6.9-6.10(6.10.1)

General References Links:

1.https://www.wp.maths.cam.ac.uk./documets/ schoedules.pdf/ [University of Cambridge]

Semester	Subject Code	Titles of the Paper	Hours of Teaching / Week	No. of Credits
V	**20U5STCPL2**	**MAJOR PRACTICAL - II (USING CALCULATOR)**	**4**	**3**

Course Objectives:

- To Acquainting the students with various statistical methods.
- To introduce students to different measurement scales, qualitative and quantitative and
- To impart discrete and continuous data.

Practical list

1. Estimation of parameters by the method of moments (Binomial distribution)
2. Estimation of parameters by the method of moments (Poission distribution)
3. Estimation of parameters by the method of moments (Normal distribution)
4. Simple Random sampling
5. Stratified Random sampling
6. Systematic Random sampling
7. Missing Plot technique in RBD (one missing observation)
8. Missing Plot technique in RBD (two missing observation)
9. Missing Plot technique in LSD (one missing observation)
10. 3^2 factorial experiments
11. Multiple and Partial Regression line and Correlation
12. Constant X and R-chart
13. Construction of p-chart

Course Outcomes:

After completion of the course, the student will be able to

- understand data classification, types of studies and types of samples.
- learnGraphical displays of data, frequency distributions, analyzing graphs.
- understand and compute various statistical measures of correlation, fitting of curve and regression.
- Gain knowledge about inferences from Binomial, Poisson and Normal distributions as illustrations.

- apply the applications to real data by means of laboratory assignments.

Note: Students should be given exposure in handling basic statistical data.

Three questions are to be answered out of five question

Semester	Subject Code	Titles of the Paper	Hours of Teaching / Week	No. of Credits
V	**20U5STEL1A**	**Major Elective - DEMOGRAPHIC METHODS**	**4**	**3**

Course Objectives:

- To demonstrate valid Demographic data using different methods.
- To teachbasic measures of Mortality, Fertility and Population Growth.
- To explain life tables.

Unit-I: 15 Hrs

Mortality measurements: crude death rate- specific death rates-standardized death rates-direct and indirect methods.

Unit- II: 15 Hrs

Mortality Table or Life Table – Stationary population –Stable population – Central mortality rate – force of mortality – Assumptions, Description & construction of life table – Uses of life tables.

Unit- III: 15 Hrs

Abridged life table – Reed – Merrell method – Greville's method – king's method.

Unit- IV: 15 Hrs

Fertility- Crude Birth rate – General Fertility Rate – Specific Fertility rate – Total Fertility Rate.

Unit -V: (Self Study)

Measurement of population Growth – Crude rate of Natural increase and pearel's vital Index – Gross Reproduction rate – Net reproduction rate.

Course outcomes:

After completion of the course, the student will be able to

- utilize the basic technique to analyse demographic data
- understand the core social demographic variables , and how these variable influence population growth , composition and structure.
- learn global demographic regimes and impact on public health.
- apply some basic methods and techniques to study population processes.
- understand the basic techniques to analyse the life table and their applications

Text Book:

Fundamentals of applied statistics by S.C.Gupta&V.K.Kapoor**References:**

1. Indian Population Problems by Agarwala, S.N (Tata McGraw Hill, Bombay)
2. Fundamentals of Applied Statistics by Guptha,S.C and Kapoor,V.K (S.Chand&Co)
3. An introduction to the study of population by Mishra D.E (South India publishers, Madras)
4. Fundamentals of Demography by DR.Hansraj (Surjeet publications Delhi)

Unit I : Chapter 9 :Sec 9.1-9.4
Unit II: Chapter 9 : Sec 9.5
Unit III: Chapter 9: Sec 9.6
Unit IV: Chapter 9: Sec 9.7
Unit V : Chapter 9: sec 9.8

General References Links:

1. https://www.nbu.ac.in/Administration/Office_SecUG/cbcs/Statistics.pdf

[National University of Singapore]

Semester	Subject Code	Titles of the Paper	Hours of Teaching / Week	No. of Credits
V	**20U5STEL1B**	**Major Elective – ECONOMETRICS**	**4**	**3**

Course Objectives:

- To demonstrate regression analysis relevant for analysing economic data.
- To teach interpretation and critical evaluation of the outcomes of empirical analysis
- To impart the validity of the economic theories and carry out their evaluation in numerical terms.
- To explain important economic policy issues from the available data.

Unit-I **15 Hrs**

Introduction to Econometrics – Nature and scope of Econometrics – Limitations

Unit – II **15 Hrs**

Concepts of price, Demand, supply, elasticity of demand, elasticity of price, elasticity of supply – simple problem

Unit – III **15 Hrs**

Simple linear model and general linear models – Simple application

Unit – IV **12 Hrs**

Ordinary Least Square (OLS) estimation – Prediction – Simple illustrations

Unit – V **(Self Study)**

Statistical problems of Econometric methods – Hetroscedasiticity and Multi colinearity

Course outcomes:

After completion of the course, the student will be able to

- apply empirical evidence to assessing economic arguments
- apply macroeconomic theories to policy discussions
- Understand validity of the economic theories and carry out their evaluation in numerical terms.
- utilize economic ideas to a broader audience
- learn the effectiveness of policy programs using sound economic techniques

Reference Books:

1. J. Johnston (1985) Econometric methods, John Wiley &Inc, New York.
2. S.P. Singh, Anil. K, Parashar and H. P.Singh (1984). Econometrics, S.Chand and Company Ltd, New Delhi.

Semester	Subject Code	Titles of the Paper	Hours of Teaching / Week	No. of Credits
V	**20U5STEL2A**	**Major Elective – SIMULATION AND PROBABILISTIC MODEL**	**4**	**4**

Course Objectives:

- To teach the techniques of constitution of Probabilistic Model.
- To teach the simulating techniques of Model.
- To teach the techniques of ABC analysis

Unit I: **15 Hrs**

Probabilistic Model-I – single period model with uniform rate of demand without setup cost (discrete and continuous units) – simple problems only.

Unit II: **15 Hrs**

Probabilistic Model-II – Single period model with instantaneous demand without setup cost (discrete and continuous units) – simple problems only.

Unit III: **15 Hrs**

Replacement problems – definition – replacement of equipment that deteriorates gradually – simple problems only.

Unit IV: **15 Hrs**

Replacement policy when value of money does not change with time and money charges with time – simple problems only.

Unit V: **(Self Study)**

Individual replacement policy – Group replacement policy – ABC analysis – Simple problemsonly.

Course outcomes:

After completion of the course, the student will be able to

- learn the operation of a dynamic system and make improvement according to the simulation results
- apply previous knowledge of probability theory to construct stochastic models of random system to use the probability theory to compute event probabilities , expected values in random environment s
- understand the theory used in probabilistic models checking.
- learn replacement theory is concerned with the situations that arrive when some items such as machines, electric light bulbs, computer, etc.,
- upgrade ABC analysis concepts and their applications

Books for Study:

1. KanthiSwarup, Gupta P.K. and Man Mohan, - *"Operations Research",* Sultan and Chand and Sons, New Delhi.

   Unit I : Chapter 19: Sec 12.1
   Unit II : Chapter 19: Sec 12.2
   Unit III : Chapter 18
   Unit IV: Chapter 18
   Unit V : Chapters 23,24

General References Links:

1. https://online.stanford.edu/courses/mse223-simulation[Stanford]
2. https://canvas.harvard.edu/courses/11248[Harvard]

Semester	Subject Code	Titles of the Paper	Hours of Teaching / Week	No. of Credits
V	**20U5STEL2B**	**Major Elective – MATLAB**	**4**	**4**

Course Objectives:

- To explain various methods of Interpolation
- To explain the techniques of two dimensional plots
- To teach basic notions and techniques of MATLAB

Unit – I: **15 Hrs**

Starting with Matlab - Creating arrays - Mathematical operations with arrays

Unit – II: **15 Hrs**

Script files - Functions and function files

Unit – III: **15 Hrs**

Two-dimensional plots - Three-dimensional plots

Unit – IV: **15 Hrs**

Programming in MATLAB

Unit – V: **(Self Study)**

Polynomials, Curve fitting and interpolation - Applications in numerical analysis

Course outcomes:

After completion of the course, the student will be able to

- learn features of MATLAB as a programming tool .
- develop programming skills and techniques to solve mathematical problem
- learn graphic features of MATLAB and they are able to use this feature effectively in the various application.
- apply MATLAB as a simulation tool
- utilize the MATLAB programme in the industry because of the hands on practical session

Text Book:

"MATLAB An Introduction with Application" by **A. Gilat,** John Wiley & Sons, Singapore, 2004.

Unit – I : Chapter 1, Chapter 2, Chapter 3.
Unit - II : Chapter 4, Chapter 6.
Unit - III : Chapter 5, Chapter 9.
Unit - IV : Chapter 7.
Unit - V : Chapter 8, Chapter 10.

Reference Books:

1. *Getting Started with MATLAB – A Quick Introduction for Scientists and Engineers"* by **R. Pratap**, Oxford University Press, New Delhi, 2006.
2. "*Introduction to Matlab 7 for Engineers"* by **W.J. Palm,** McGraw-Hill Education, New York, 2005.
3. "*Introduction to MATLAB 7"* by **D. M. Etter, D. C. Kuncicky and H.Moore**,Prentice Hall, New Jersy, 2004.

Semester	Subject Code	Titles of the Paper	Hours of Teaching / Week	No. of Credits
V	**20U5STNME**	**MATRIX ALGEBRA**	**2**	**1**

Course Objectives:

- To explain the basic notions and techniques of matrices and vectors.
- To impart the matrix methods and related mathematical techniques required for pursuing core areas of statistics.
- To teach methods for solving systems of linear equations involving unknown quantities,
- To acquire competence in algebraic methods involving matrices, determinants, Eigen

Unit- I **8Hrs**

Definition of Matrix – Addition, Subtraction, Multiplication of Matrices

Unit-II **7 Hrs**

Transpose of a Matrix – Adjoint of a Matrix – Inverse of the Matrix.

Unit-III **8Hrs**

Symmetric, Skew symmetric, Hermitian and Skew Hermitian Matrix –

Problems.

Unit-IV **7Hrs**

Rank of the Matrix- Definition – Finding Rank of the Matrix – Problems up to 3x3 Matrix.

Unit-V (Self Study)

Cayley Hamilton Theorem (Statement only) – Problems only

Course outcomes:

After completion of the course, the student will be able to

- learn linear equations and the properties of matrices
- apply the mathematical analysis and implementation of theory and algorithms used to solve linear algebra problems in practice.
- acquire further skills in the techniques of linear algebra, as well as understanding the principles underlying the subject.
- learn covers the notions of vectors, matrices, linear equations, linear transformations, Eigen values and vectors, and quadratic forms.
- learn rank of matrix and the properties of matrices

Text Books:

Dr.P.R. Vittal -Allied Mathematics - Margham Publications, Chennai-17 (2000)

Semester	Subject Code	Title of the Paper	Hours of Teaching / Week	No. of Credits
V	**20U5STLSD**	**Life skill development**	**1**	

Course objectives

- To enhance one's ability to be fully self aware by helping oneself to overcome all fears and insecurities and to grow fully from inside out and outside in.
- To increase one's knowledge and awareness of emotional competency and emotional intelligence at place of study/work.
- To provide opportunity for releasing one's potential through practical experience.
- To develop interpersonal skills and adopt good leadership behaviour for empowerment of self and others.
- To set appropriate goals, manage stress and time efficiently.
- To manage competency- mix at all levels for achieving excellence with ethics.

Unit – I (30 hrs)

Communication and Professional skills

1. Writing and different modes of writing. (4 hrs)
2. Digital Literacy. (4 hrs)
3. Effective use of social media. (3 hrs)
4. Non verbal communication. (2 hrs)
5. Resume skills. (3 hrs)
6. Presentation skills. (4 hrs)
7. Listening as a Team skill. (2 hrs)
8. Brainstorming. (2 hrs)
9. Social and cultural Etiquettes. (4 hrs)
10. Internal communication. (2 hrs)

Unit – II (30 hrs)

Leadership, management and Universal Human Value

1. Leadership skills. (4 hrs)
2. Managerial skills. (4 hrs)
3. Entrepreneurial skills. (4 hrs)
4. Innovative Leadership and Design thinking. (4 hrs)
5. SWOT Analysis (4 hrs)
6. EQ (2 hrs)
7. Love and Compassion. (4 hrs)
8. Truth. (1 hr)
9. Non Violence. (1 hr)
10. Righteousness. (1 hr)
11. Ethic and Integrity. (1 hr)

Course outcomes

At the end of the programme learners will be able to:

- Gain Self Competency and Confidence.
- Practice Emotional Competency.
- Gain Intellectual Competency.
- Gain an edge through Professional Competency.
- Aim for high sense of Social Competency.
- Be an integral Human Being.

References:

1. Bailey, Stephen, Academic Writing : A handbook for International Students, 2010 Rourlege.
2. Shlpa Sablok Bhardwaj (2018). Computer Applications for Class 9 MS Office Blueprint Education (Contributor).
3. http:// WWW.lyfemarketing.com / blog / how-digital – marketing – works/
4. http:// WWW.thoughtco.com/what-is-nnverbasl - communication - 1691351
5. http:// WWW.wikihow.com/Write-a-Neat-Resume
6. http:// WWW.gildabonanno.com/presentation-skill-coaching-videos
7. http:// blog.vantagecircle.com/active-listening/
8. Osborn, A.F. (1963) Applied imagination: Principles and procedures of creative problem solving (Third Revised Edition). New Yok, NY: Charles Scribner's Sons.
9. http:// WWW.thespruce.com/what - is - etiquette – and – why – is- it- important – 1216650
10. http:// WWW.talkfreely.com/blog/internal-and-eternal-communication

Semester	Subject Code	Titles of the Paper	Hours of Teaching / Week	No. of Credits
V I	**20U6STC11**	**NUMERICAL ANALYSIS**	**5**	**5**

Course Objective:

- To introduce basic numerical concepts related to business applications
- To summarize and critically analysesNewton's method.
- To provide lagranges interpolationforreal life data analysis.

Unit I: **19 Hrs**

Iteration method or Method of successive approximation – Newton's method (or) Newton-Raphson method- Solution of simultaneous linear algebraic equations: Gauss Elimination Method – Gauss-Jordan Method – Jocobi's (or Gauss-Jocobi's) Iteration Method

Unit II: **19Hrs**

Interpolation: Newton's Forward Interpolation formula – Backward Differences – Newton's Backward Interpolation formula – Central Differences: Gauss 's Forward Formula – Gauss's Backward Formula – Stirling's Formula.

Unit III: **19 Hrs**

Interpolation with unequal intervals: Divided differences – Newton's divided difference interpolation formula for unequal intervals – Lagrange's Interpolation formula.

Unit IV: **18Hrs**

Quadrature formula for equidistant ordinates: Trapezoidal rule - Romberg's method– Simpson's *1/3*rd and *3/8*th rules Rule – Truncation error in the Trapezoidal rule – Truncation error in Simpson's rule.

Unit V: **(Self Study)**

Runge-Kutta method for simultaneous first order differential equations - Predictor Corrector methods: Milne's Predictor Corrector formulae – Adam Bashforth(or Adam's) Predictor Corrector formulae.

Course outcomes:

After completion of the course, the student will be able to

- understand the uses of interpolation in various fields.
- analyse the solution of algebraic equations.
- learn the usage of numerical differentiation and integration.
- learn the importance of Lagrange's problem in interpolation..
- learn the role of Picard's method for successive approximation.

Books for study:

1. *Numerical Methods* by Kandasamy. P. Thilagavathy,. K and Gunavathy.K (2003), S.Chand& Co, New Delhi.

2. *Numerical Methods* by A.Singaravelu, Meenakshi Agency, Chennai-2.

Unit I : chapter 3,4: Sec3.2,3.4,4.2,4.2.1,4.8
Unit II : Chapter 6,7 : Sec 6.1-7.8
Unit III: Chapter 8 : sec 8.1 -8.8
Unit IV : Chapter 9 : Sec 9.7-9.16
Unit V : Chapter 11: Sec 11.14,11.16,11.17,11.18
General References Links:
1.https://courses.maths.ox.ac.uk/node/44065[Oxford]
2. https://explorecourses.stanford.edu/search?q=CME206 [Stanford]

Semester	Subject Code	Titles of the Paper	Hours of Teaching / Week	No. of Credits
VI	**20U6STC12**	**OPERATIONS RESEARCH**	**5**	**5**

Course Objectives

- To impart knowledge on how to formulate a real –life problem in a mathematical form and find a criterion for solving it.
- To impart Choose the best (optimal) alternative among the available alternative courses of action.
- To explore various techniques available in Operations Research.
- To impart the techniques in different areas such as transportation, production and marketing.

UNIT – I: 19 Hrs

Introduction to O.R. Introduction – origin and development – nature and features – modeling in O.R. – general solution methods – scientific method – methodology of O.R. – applications of O.R. – opportunities and shortcomings of O.R. – limitations of O.R.- Linear Programming Problem - Mathematical formulation of L.P.P. – graphical solution of L.P.P.

UNIT – II: 19 Hrs

Simplex methods – problems - Use of artificial variable – big-M method – two phase methods – problems - Concepts of Primal and dual problems.

UNIT–III: 19 Hrs

Transportation and Assignment model in O.R.:- General transportation problem – transportation table – loops in transportation tables – L.P.formulation of the T.P. – north west corner method – least cost or matrix minima method – Vogels' approximation method – Assignment problem**:** Introduction – Mathematical formulation of the problem –assignment method.

UNIT – IV: 18 Hrs

Game theory:- Introduction – method of solving game theory problems – games with mixed strategies – game with dominance – games with Arithmetic method – use of linear programming in solving a game – graphical solution to a game – approximate solution of a game.

UNIT – V: (Self Study)

PERT / CPM:- Introduction – Concept of network – rules for construction of network – dummy activities – to find the critical path – algorithm for critical path – PERT model – CPM model.

Course outcomes:

After completion of the course, the student will be able to

- learn the role of Linear Programming Problem in real life problem.
- understand the relationship between dual and primal problem.
- analyse the uses of Travelling sales man problem in marketing industry.
- utilize the role of Transportation problems in Transport company.
- utilize the importance of Assignment problems in a company.

TEXT BOOK:

Operations Research, Sultan Chand & Sons, New Delhi (2006) P.K.Gupta, KantiSwarup and Man Mohan.

Unit I : Chapter 1 : Sec 1.1 to 2.2
Unit II : Chapter 8 : Sec 8.4
Unit III : Chapter 10 : Sec. 10.1 – 10.9,Chapter 11 : Sec. 11.1 – 11.6
Unit IV : Chapter 17 : Sec. 17.1 – 17.11
Unit V : Chapter 21: Sec 21.1 to 21.7

Books for Reference:

- *Problems in Operations Research*, Sultan Chand & Sons, New Delhi (2006). - P.K.Gupta and Man Mohan.
- *Operations Research-An Introduction*, Mac Millan Publishing Company, New York (1982). – HamdyA.Taha.

General ReferenceLinks:

1. https://web.stanford.edu/group/sisl/k12/optimization/#!index.md[Stanford]
3. http://www.philadelphia.edu.jo/it/cs/syllabus/750471.pdf[Philadelphia

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Semester	Subject code	Title of the paper	Hours of Teaching/ Week	No.of Credits
VI	**20U6MAC13**	**Introduction to R - Programming**	**5**	**5**

Course Objective:

- To impart efficient Data Handling Techniques
- To equip students with Statistical Programming Skills based on real life examples and datasets
- To explain critical programming language concepts
- To Configure statistical programming software and Collect detailed information using R profiler

Unit I **15 Hrs**

R as a statistical software and language – R as a calculator – R Prelimaries – Methods of Data Input – Data Accessing or indexing – Built-in Function.

Unit II **15Hr**

Graphics with R – Graphics Functions – Saving, Storing and Retrieving Work – Diagrammatics Representation of Data – Graphical Representation of Data – Measures of Central Tendency and Dispersion.

Unit III **15 Hrs**

Probability: Definition and Properties – Probaboility Distributions – Some Special Discrete Distributions-Continuous Probability Distributions

Unit IV **15 Hrs**

Statistical Inference: Introduction-Sampling Distribution of Sample MeanEstimation of Parameters-Plot to Check normality.

Unit V **15 Hrs**

Linear Regression – Linear Regression Model – Model Assumptios – Linear Calibration – Inferencce Procedures for Simple Linear Model – Validation of Linear Regression Model.

Course out comes:

After completion of the course, the student will be able to

- understand the basics in R in terms of construct, control statements and string Function.
- perform various operations and apply common function to manipulate and analyze data using basic R syntax
- apply the R programming from Statistical perspective
- visualize data attributes using ggplot and other Statistical packages
- apply R programming for data analytics and model building

Text Book:

Sudha G. Purohit, Sharad D. Gore, Shailaja R. Deshmukh, Statistcs Using R, Narosa Publishing House Pvt. Ltd., 2nd Ed., 2015.

Unit I : Chapter 1 (Section 1.1 to 1.7)
Unit II : Chapter 1 & 2 (Sections 1.8 to 1.10 & 2.1 to 2.5)
Unit III : Chapter 3 (Sections 3.1 to 3.5)
Unit IV : Chapter 4 (sections 4.1 to 4.4)
Unit V : Chapter 5 (Section 5.1 to 5.6)

General References:

1. John Maidonald and John Braun, Data Analysis and Graphics Using R, Cambridge University Press, Cambridge, 2010.
2. Brian Bveritt and TorstenHothorn, A Handbook of Statical Analyses using R, Chapman & Hall / CRC, Boca Raton, FL, 2009.

References Links : https://www.training.cam.ac.uk/event/1572331
https://www.imperial.ac.uk/research-and-innovation/support-for-staff/stats-adviceservice/courses/r-courses/r-intro/

Semester	Subject code	Title of the paper	Hours of Teaching/ Week	No.of Credits
VI	**20U6STCPL3**	**MAJOR PRACTICAL - III (Using Statistical Software Package)**	**4**	**3**

Course Objectives

- To explain how to start SPSS and define a variety of statistical variables.
- To impart hands-on experience undertaking common data management steps in SPSS.
- To teach statistical analysis, selecting the most appropriate techniques and methods forcollecting and processing statistical data.

Practical list

1. Calculate Bar diagram, Pie diagram and frequency table
2. Measure of central Tendency: mean, median, mode, Geometric mean and Harmonic mean
3. Measures of dispersion: Quartiles, Deciles and percentiles and Standard Deviation
4. Measures of Skewness and Kurtosis
5. co-efficient of Correlation and Rank Correlation
6. Calculate Simple Regression co-efficient and multiple linear Regression
7. Test of significance are One Sample Test and Two Sample Test
8. Paired t-test, Chi-square test
9. Analysis of variation : One way and Two way classification
10. Non-parametric test : mann-whitney test (Independent sample)signed rank test [for Difference sample]

Note: Students should be given exposure in handling basic statistical data.

Three questions are to be answered out of five question.

Course outcomes:

After completion of the course, the student will be able to

- understand how to create a database in SPSS, including entering survey/questionnaire data.
- learn integrate and manage the database in SPSS
- analyse and apply the appropriate diagrams, statistical charts and graphs.
- recommend the best statistical tool for basic statistical analysis.
- apply Statistical technique with confidence and interpret the output.

Semester	Subject code	Title of the paper	Hours of Teaching/ Week	No.of Credits
VI	**20U6STEL3A**	**Major Elective – ACTUARIAL STATISTICS**	**5**	**3**

Course Objective:

- To impart basic concepts in actuarial studies
- To prepare students to take up a career in Actuarial Practice
- To explore some of the fiscal and ethical dilemmas often encountered in the process of business decision-making.

Unit - I: **19 Hrs**

Present value and accumulated value at fixed rate and varying rates of interest – effective rate of interest corresponding to a nominal rate of interest and vice-ersa – Simple problems – annuity – types of annuities excluding perpetuity – derivation of the formula for an%, sn%, a..n% and s..p% simple problems.

Unit – II: **19 Hrs**

Derivation of the formula for a(p) n%, s(p) n%, a..(p) n% and s..(p) n% simple problems – redemption of loan by uniform early payment – definitions of sinking fund – redemption of loan by a sinking fund (uniform early payment) simple problems.

Unit – III **19 Hrs**

Mortality table: Definition- Uses – mentioning the types and the construction of a mortality table – complete and incomplete mortality table – computing the probabilities of survival and death using LIC (1970-1973) Mortality table- defining expectation of life, complete expectation of life and central death rate – simple problems.

Unit – IV **18 Hrs**

Principles of Insurance – Types of assurance – temporary assurance, pure endowment assurance, endowment assurance and whole life assurance – Expressions for present values of assurance benefits under temporary assurance, pure endowment assurance, endowment assurance and whole life assurance plans.

Unit – V: **(Self Study)**

Definitions of premium, Natural premium level, Annual Premium, Net Premium and Office Premium – Expressions for level annual premium under temporary assurance, pure endowment assurance, endowment assurance and whole life assurance plans – simple problem involving the calculations of level annual present annual premium, office premium and the four types of plans only.

Course outcomes:

After completion of the course, the student will be able to

- analyse financial risks in the insurance and finance fields, using mathematical and statistical methods
- aquire knowledge in foundational areas of mathematics as well as finance and economics essential to the actuarial field.
- apply probability analysis and statistics to define, analyze, and solve the financial impact of uncertain future events.
- understand actuarial techniques accurately, precisely and effectively by developing mathematical and critical thinking.
- learn appear in the actuarial examinations conducted by different societies and complete it successfully

Reference Books:

1. Mathematics Basis of Life Insurance – Insurance Institute of India.
2. Mathematics of Finance – Scheme Series.

General References Links:

1. https://olin.wustl.edu/docs/SMP/MSFC-curriculum-course-descriptions.pdf [Washington]
2. http://www.stats.ox.ac.uk/wp-content/uploads/2019/09/Part-B-2019-2020Handbook-Supplement.pdf [Oxford]

Semester	Subject code	Title of the paper	Hours of Teaching/ Week	No.of Credits
VI	**20U6STEL3B**	**Major Elective – GENETICAL STATISTICS**	**5**	**3**

Course objectives:

- To impart the contributions made by world famous scientists in the field of drug discovery and learn the steps involved in clinical trials.
- To impart the study designs in medical research into the right type of observational or experimental study.
- To Determine and Apply correct statistical inference procedures with adequate sample size to infer problems related to Biostatistics

Unit – I **19 Hrs**

Chromosomes and Genes – meaning of basic terms

Unit – II **19 Hrs**

Genotype and phenotype, dominance &recessiveness

Unit – III **19 Hrs**

Autosomal linkage - crossing over – sex – linked inheritance sample space – Random events – probability

Unit – IV **18 Hrs**

Compound events – Laws of probability – conditional probability – Rendel"s laws (I & II)

Unit – V **(Self Study)**

Genotypes and phenotypes in experimental populations – No.of genotypes and phenotypes – Evaluation of phenotypic ratios in the off spring of inter crosses and back crosses, using generating function.

Course outcomes:

After completion of the course, the student will be able to

- utilize Genes carry instructions that tell you cells how to work and grow
- utilize the characteristics of an organism that result from the intraction it's genotype with the environment
- learn different techniques utilized in genome analysis and recombinant DNA technology.
- understand the role of genetic technologies in industries related to biotechnology,pharmaceuticals,energy and other fields
- learn the physical and behavioral trials of the organism

References Books:

1.Ragira C. Elandt: Probability models and Statistical methods in Genetics, John – Wiley and Sons Inc, New Delhi

Semester	Subject code	Title of the paper	Hours of Teaching/ Week	No.of Credits
VI	**20U6STEL4A**	**Major Elective – TIME SERIES AND INDEX NUMBERS**	**5**	**4**

Course Objective:

- To acquaint the basic problems in the construction of index numbers and to know varioustypes of index numbers.
- To impart the numerous scaling procedures and reliability of test scores pertaining to Education and Psychology.
- To teach the demand and supply of various products with respect to their elasticity.

Unit I: 19 Hrs

Components of time series – additive and multiplicative models, uses of time series,measurement of trend – graphic method, method of semi-averages – method of movingaverages, method of least squares (linear quadratic and exponential) – simple problems.

Unit II: 19 Hrs

Measurement of seasonal fluctuations – method of simple averages – ratio to trend methodratio to moving average and link relative method – concept of cyclic variations and irregularmovements.

Unit III: 19 Hrs

Definition and types of index numbers – construction and uses of index numbers-calculations of index numbers – fixed base and chain base index numbers.

Unit IV: 18 Hrs

Weighted average of price relative method (by using A.M. and G.M.) – construction of chainindices - The criteria of a good index number – time reversal and factor reversal methods andfamily budget method – simple problem

Unit V: (Self Study)

Cost of Living Index Number-Contribution of Cost of Living Index-Uses of Cost Living Index Number-Family Budjet Method-Simple Problems

Course outcomes:

After completion of the course, the student will be able to

- understand and present data meaningfully
- apply summary measures of averages and dispersion to draw useful conclusions
- analyze the strengths of relationship between variables.
- analyse suitable statistical models to forecast various business related problem
- explore problem solving skills in competitive exams like combined statistical subordinate service exam (Group –IV).

Text Book :

1. S.C.Gupta and V.K.Kapoor – *"Fundamentals of Applied Statistics",* Sultan Chand and Sons, New Delhi.
2. Goon.A.M.M.A Gupta and Das Gupta B – *"Fundamentals of Statistics",* Vol. II, World Press, Calcutta.

Unit I : Chapter 2 : Sec2.1 -2.4
Unit II: Chapter 2 : Sec2.5 -2.6
Unit III: Chapter 3: Sec 3.3
Unit IV: Chapter 3: sec 3(3.3.3-3.3.4),3.4
Unit V : Chapter 3 : Sec 3 (3.5.2) **General**

References Links:

1. https://math.wustl.edu/sites/courses/wucrsl/L24/461/FL2019 [Washington University]
2. http://ww.irwincollier.com/harvard-syllabusfor-undergraduate-course-economicstatistics-frickey-1940-41/[Harvard University]

Semester	Subject code	Title of the paper	Hours of Teaching/ Week	No.of Credits
VI	**20U6STEL4B**	**Major Elective – STATISTICAL DATA ANALYSIS**	**5**	**4**

Course Objectives:

- To introduce basic statistical concepts related to business applications
- To summarize and critically analyse business data.
- To provide statistical techniques for business data analysis.
- To impart the knowledge of statistical tools for drawing meaningful inferences

Unit I: 19 Hrs

Collection of statistical data - primary and secondary – methods - preparation of questionnaire and schedules.

Unit II: 19 Hrs

Classification and tabulation – bar diagrams – pie diagram – histogram – frequency polygon – frequency curve – merits and demerits.

Unit III: 19 Hrs

Measures of central tendency – mean, median, mode – measures of dispersion – range, mean deviation, standard deviation and coefficient of variation.

Unit IV: 18 Hrs

Measures of skewness – definition – types – methods – Karl Pearson's skewness – Bowley'sskewness – merits and demerits – simple problems only.

Unit V: (Self Study)

Correlation analysis – Karl Pearson's coefficient of correlation – Spearman's rank correlation coefficient – simple problems only.

Course outcomes:

After completion of the course, the student will be able to

- analyse and apply the appropriate diagrams, statistical charts and graphs
- recommend the best statistical tool for basic statistical analysis.
- apply Statistical technique with confidence and interpret the output.
- facilitates a clear and simple presentation of the data ,a clear expression of the implication and an easier and more convenient comparison.
- understand it measures the relationship between two variables via a line.

List of books for study / reference:

1.S.P.Gupta – *"Statistical Methods",* Sultan and Chand and Sons, New Delhi

Semester	Subject code	Title of the paper	Hours of Teaching/ Week	No.of Credits
-	**-**	**Core Optional - VITAL STATISTICS**	**5**	**5**

Course Objectives:

- To teach Demographic data using different methods.
- To teach basic measures of Mortality, Fertility and Population Growth.
- To explain life tables.

Unit I: **19 Hrs**

Introduction – definition of vital statistics, uses of vital statistics , method of obtaining vital statistics, registration method, census enumeration – analytical method.

Unit II: **19Hrs**

Measurement of fertility – CBR (crude birth rate) – SFR (specific fertility rate) – ASFR (age specific fertility rate) – GFR (general fertility rate) – TFR (total fertility rate)

Unit III: **19 Hrs**

Reproduction rate – gross reproduction rate – net reproduction rate.

Unit IV: **18 Hrs**

Measurement of mortality – specific death rate – standardized death rate – infant mortality.

Unit V: **(Self Study)**

Life tables – uses of life table – construction of a life table.

Course outcomes:

After completion of the course, the student will be able to

- understand data related to time, psychology and life
- learn Mortality and Fertility rates are arrived at using vital statistics.
- understand different Scaling procedures are studied for educational and Psychological data
- learn Concepts of Stable and Stationary Populations.
- learn Concept of Life Tables, their construction and uses

List of books for study / reference:

S.P.Gupta – *"Statistical Methods",* Sultan and Chand and Sons, New Delhi.

Semester	Subject code	Title of the paper	Hours of Teaching/ Week	No.of Credits
-	**-**	**Core Optional – Game Theory**	**5**	**5**

Course objective

- To teach strategic interactions amongst rational decision makers.
- To provide students with a comprehensive treatment of game theory with specific emphasis on applications in Economics and Engineering
- To explain and model strategic situations, to predict when and how their action will have an influence on others, and to exploit strategic situationfor the benefit of their own

Unit I: **19 Hrs**

Introduction game theory – Definition of game, Application of game and its uses, properties

Unit II: **19 Hrs**

Method of solving game theory problems - maximin, minimax principle, saddle point

Unit III: **19 Hrs**

Two person Zero sum game - games with mixed strategies – problems

Unit IV: **18 Hrs**

Dominance property- game with dominance – games with Arithmetic method – problems

Unit V: **(Self Study)**

Linear programming in solving a game – graphical solution to a game (mx2 and 2xn) - approximate solution of a game- problems

Course outcomes:

After completing the course, student will be able to

- promote a game situation from a pure individual's decision problem,
- learn concepts of players, strategies, payoffs, rationality, equilibrium,
- upgrade sequential games using game trees, and to use the backward induction to solve such games,
- learn simple simultaneous-move games using game tables, and to explain concepts of dominant, dominated, and rationalizable strategies, pure and mixed strategies, and best responses,
- emphasize dominant strategy equilibrium, pure and mixed strategy Nash equilibrium

TEXT BOOK:

Operations Research, Sultan Chand & Sons, New Delhi (2006) P.K.Gupta and Man Mohan KantiSwarup, P.K.Gupta and Man Mohan.

Books for Reference:

1. *Problems in Operations Research*, Sultan Chand & Sons, New Delhi (2006). - P.K.Gupta and Man Mohan.
2. *Operations Research-An Introduction*, Mac Millan Publishing Company, New York (1982). – HamdyA.Taha.

Semester	Subject code	Title of the paper	Hours of Teaching/ Week	No.of Credits
-	**-**	**Core Optional** **NON-PARAMETRIC TESTS**	**5**	**5**

Course objective:

- To impart of theoretical concepts of Bivariate Normal and Multivariate Normal Distributions along with their properties.
- To explain multivariate data.
- To explain Wald's SPRT and Non-Parametric methods of testing of hypothesis.

Unit – I **19 Hrs**

Introduction of non-parametric test – its comparison with parametric test – Advantage and limitations of non-parametric tests

Unit – II **19 Hrs**

Test for randomness – Run test – Test for rank correlation co-efficient – Sign test.

Unit – III **19 Hrs**

Comparison of two populations: median test – Mann Whitney U test – Wilcoxon signed rank test for paired observations.

Unit – IV **18 Hrs**

Comparison of several populations: Median test for several samples – KruskalWalli"s test – Friedman ANOVA.

Unit – V **(Self Study)**

Testing of goodness of fit by Kolmogorov – Smirnov test – chi-square test for uniformity of data – Distinction between non-parametric and distribution free tests.

Course outcomes:

After completion of the course, the student will be able to

- learn the contributions made by world famous scientists in the field of drug discovery and learn the steps involved in clinical trials.
- learn the study designs in medical research into the right type of observational or experimental study.
- understand and Apply correct statistical inference procedures with adequate sample size to infer problems related to Biostatistics
- learn Recommend the best distribution fit for the given survival data and also compare survival curves using visualization and statistical test of significance
- analyse Cox PH model for Survival Data and to estimate Adjusted survival functions for individuals and group

References Books:

1. J.D.Gibbons (1976) : Non-parametric methods for quantitative analysis, New York.

2. J.V.Desphande ,A.P.Gune, A.Shanubhogur : Statistical Analysis of non-normal data.

3. Richard I. Lerin : Statistics for Management, Practice Hall of India, New Delhi.

Semester	Subject code	Title of the paper	Hours of Teaching/ Week	No.of Credits
-	**-**	**Core Optional APPLIED STATISTICS**	**5**	**5**

Course Objectives:

- To teach auto regression series of first order and second order
- To teach techniques and approach of SQC being used in industry to manufacture goods and services of high quality at low cost.
- To impart logistic curve and Index Numbers.

Unit – I 19 Hrs

Concept of time series – Source of time series data – Component of time series – Additive and Multiplicative models – Resolving the components of time series – Trend – Methods of measuring trend – Semi average method – Method of moving average – Method of least squares – First order & second order polynomials and logistic curves

Unit – II 19 Hrs

Seasonal variation – Seasonal index – Methods of measuring seasonal index – Simple average method – Ratio to moving average - Ratio to trend method – Link relatives method – Cyclical variation – Measurement of cyclical variation – Method of periodogram analysis – Auto regression series of first order and second order – Auto correlation and correlogram analysis – Random components -Variate difference method.

Unit – III 19 Hrs

Basis of Index Numbers – Definition – uses - Problems in the construction – Different types of Index Numbers – Simple Index Numbers – Weighted Index Numbers – Laspeyre"s Index Numbers – Paasche"s Index Numbers – Fisher"s Index Numbers – Marshall & Edge worth Index Numbers – Dorbish&Bowley"s Index Numbers

Unit – IV 18 Hrs

Optimum tests of Index Numbers – Time reversal test – Factor Reversal Test – Circular Test – Chain base Index Number – Conversion of FBI into CBI and Vice versa – Uses of Index Numbers - Wholesale price Index Numbers (Concept only)

Unit – V (Self Study)

Cost of living Index Numbers – Methods of construction – Aggregate method – Family budget method – splicing and deflating – Base shifting – Uses of cost of living Index Numbers.

Course outcomes:

After completion of the course, the student will be able tp

- learn Index Number, Time series ,Vital Statistics ,Psychological statistics, Demand and supply functions and explain their applications.
- learn Price ,Quantity Index numbers, trend and seasonal variations and different types of scores for psychological data and to compute different mortality and fertility rates

- learn select the best tool in the construction of index number, the best method of determining test reliability and to decide the best model for Time series data.
- learn construct life tables, polynomial models for time series data and develop models for demand and supply data.

- understand tme series data ,its component and its applications to various field.

Reference Books:

1. A.M.GoonM.K.Gupta and B.Das Gupta (1994), Fundamentals of Statistics V-II, The world press Ltd., Culcutta.
2. Croxton : Applied General Statistics.
3. S.C.Gupta, V.K.Kapoor, (2007):Fundamentals of Applied Statistics, Sultan Chand & Sons, New Delhi.

Semester	Subject code	Title of the paper	Hours of Teaching/ Week	No.of Credits
-	**-**	**Core Optional COMPUTATIONAL STATISTICS**	**5**	**5**

Course Objectives

- To impart the basic concepts of statistics.
- To explain the ability to deal with numerical and quantitative issues in relevant field.
- To impart the use of statistical, graphical and algebraic techniques wherever relevant.

Unit I: 19 Hrs

Primary and secondary – preparation of questionnaire and schedules merits and demerits.

Unit II: 19 Hrs

Classification and tabulation –Types of bar diagrams – pie diagram – histogram – frequency polygon – frequency curve – merits and demerits.

Unit III: 19 Hrs

Measures of central tendency – mean, median, mode – measures of dispersion – range, mean deviation, standard deviation and coefficient of variation simple problems.

Unit IV: 18 Hrs

Measures of skewness – definition – types – methods – Karl Pearson's skewness – Bowley'sskewness – merits and demerits – simple problems only.

Unit V: (Self Study)

Correlation analysis – Karl Pearson's coefficient of correlation – Spearman's rank correlation coefficient – simple problems only.

Course outcomes:

After completion of the course, the student will be able to

- analyse and apply the appropriate diagrams, statistical charts and graphs.
- learn the best statistical tool for basic statistical analysis.
- apply Statistical technique with confidence and interpret the Output
- understand relationship between factors and quantify the same.
- learn the ability to deal with numerical and quantitative issues in relevant field.

Books for study / reference:

S.P.Gupta – *"Statistical Methods",* Sultan and Chand and Sons, New Delhi

Semester	Subject code	Title of the paper	Hours of Teaching/ Week	No.of Credits
-	**-**	**Core Optional – BIO – STATISTICS**	**5**	**5**

Course Objective:

- To impart the applications of Statistical Measures in health sciences.
- To explore various Data Visualizations and Statistical Inference in Biostatistics and Survival Analysis
- To explore the applications of Statistical Models in Survival Analysis
- To encourage Students to take up a career as Biostatistician

UNIT I **19 Hrs**

Biostatistics – definition – types of data – Quantitative, Qualitative data – Sources of data in life science – Limitation and uses of statistics.

19 Hrs

UNIT II

Collection of data – primary data, designing questionnaire and schedule – Secondary data – Methods of collection of data – classification of data – Tabulation and presentation of data

UNIT III **19 Hrs**

Measures of Central Tendency – Mean, Median, Mode, Geometric Mean – Merits and Demerits. Measures of dispersion – Range, Standard deviation, Mean deviation, Quartile deviation, Merits and demerits, coefficient of variations

UNIT IV **18 Hrs**

Correlation – Types and methods of correlation, Rank – Correlation, Regression, Simple regression equation, fitting, Prediction

UNIT V **(Self Study)**

Sampling Methods – population. Sample – Simple Random sample – concept of sampling distributions – standard error – Test of significance – Hypothesis – Simple hypothesis – Tests based on large samples and small samples – Chi-square test.

Course Learning Outcomes:

After completion of the course, the student will be able to

- learn The fundamental concepts of survival functions and their interrelationship.
- understand Survival distributions and their applications.
- understand Handling censored data and estimating mean survival time
- learn Basic concept of genetics

- learn the applications of Statistical Measures in health sciences

References:

1. P.S.S. SundarRao, J. Richard (2012).An introduction to Biostatistics and Reaserch methodology. Fifth Edition,Prentice Hall of India Learning Private Ltd, New Delhi. Price RS.275/-.
2. Gurumani N (2005). An introduction to Biostatistics. 2nd Revised Edition, MJP Publishers, Chennai. PriceRs.160/-.
3. Daniel WW, (1987). Biostatistics, John Wiley and Sons, New York.
4. Dr. Pranab Kumar Banarjee. An Introduction to Biostatistics (A text book of Biometry). Reviced and 4th enlarged Edition 2011,S. Chand and Company Ltd, Ram Nagar, New Delhi. Price RS. 175/-.
5. A.Indrayan, L. Sathyanarayana(2006).Biostatistics for Medical,Nursing and Pharmacy students. Prentice Hall of India Private Ltd, New Delhi.