PSG College of Arts & Science

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Since 1947

B.Sc. STATISTICS

2017 - 2020

BSc STATISTICS

SCHEME OF EXAMINATIONS

(For students admitted in June 2014 & onwards)

CODE NO.	SUBJECT	EXAM DURA-TION (Hrs)	Max. Marks			Credit points
			CA	CE	Total	
First Semester						
	Part –I					
14LAU01 12LAU01 14LAU01	Tamil – I OR Hindi – I OR French-I	3	25	75	100	3
	Part –II					
14EU01	Communicative English - I- Interpersonal Communication	3	25	75	100	3
	Part –III					
14STU01	Descriptive Statistics	3	25	75	100	4
14STU02	Matrices	3	25	75	100	4
14STU03	Mathematics – I (Allied-MA)	3	25	75	100	5
--	Statistics Practical – I	-	-	-	-	-
Second Semester						
	Part –I					
14LAU02 12LAU02 14LAU02	Tamil – II OR Hindi – II OR French-II	3	25	75	100	3
	Part –II					
14EU02	Communicative English II– Academic Communication	3	25	75	100	3
	Part –III					
14STU04	Numerical Methods	-	100	-	100	3

14STU05	Time Series and Index Numbers	3	25	75	100	4
14STU06	Mathematics – II (Allied-MA)	3	25	75	100	5
14STU07	Statistics Practical – I	3	40	60	100	4
	Part –IV					
14VEU01	Value Education	--	100	--	100	2
Third Semester						
	Part –I					
14LAU03 12LAU03 14LAU03	Tamil – III OR Hindi – III OR French-III	3	25	75	100	3
	Part –II					
14EU03	Communicative English III- English for Career	3	25	75	100	3
	Part –III					
14STU08	Real Analysis	-	100	-	100	4
14STU09	Probability Distributions	3	25	75	100	3
14STU10	Accountancy (Allied-CO)	3	25	75	100	5
	Statistics Practical – II	-	-	-	-	-
	Part –IV					
14ESU01	Environmental Studies	--	100	--	100	2
Fourth Semester						
	Part –I					
14LAU04 12LAU04 14LAU04	Tamil – IV OR Hindi – IV OR French-IV	3	25	75	100	3
	Part –II					
14EU04	Communicative English- IV English Through Literature and Newspapers	3	25	75	100	3
	Part –III					
14STU11	Statistical Inference – I	3	25	75	100	3

14STU12	Basic Sampling Theory	3	25	75	100	4
14STU13	Mathematical Economics (Allied-ST)	-	100	-	100	5
14STU14	Statistics Practical – II	3	40	60	100	4
	Part –IV					
14SBU01	**Skill Based Subject :** Internet Security	--	100	--	100	2

CODE NO.	SUBJECT	EXAM DURA-TION (Hrs)	Max. Marks			Credit points
			CA	CE	Total	
Fifth Semester						
	Part –III					
14STU15	Statistical Inference – II	3	25	75	100	3
14STU16	Educational & Psychological Statistics	-	100	-	100	4
14STU17	Statistical Quality Control –I	3	25	75	100	4
14STU18	***Core Elective-I*** **:** Operations Research – I	3	25	75	100	4
	Statistics Practical – III	-	-	-	-	-
14STU19	Big Data Analytics	-	100	-	100	4
	Computer Based Statistics Practical (**SPSS**)	-	-	-	-	-
	Part –IV					
14NME01	**Non-Major Elective (1) :** EDC	--	100	--	100	2
14NME02	**Non-Major Elective (2) :** General Awareness (On-line Test)	1½	--	100	100	2
Sixth Semester						
	Part –III					
14STU20	Demographic Methods	3	25	75	100	4
14STU21	Design of experiments	3	25	75	100	4
14STU22	Statistical Quality Control-II	3	25	75	100	4
14STU23	***Core Elective-II*** **:** Operations Research – II	3	25	75	100	4
14STU24	Econometrics	3	25	75	100	4
14STU25	Statistics Practical –III	3	40	60	100	4
14STU26	Computer Based Statistics Practical **(SPSS)**	3	40	60	100	2

Hands on Training in Information Technology (offered by the Department)		**8**
Total Credits		**144**

PART-V			**Credits**
1.	**Extension Activity** : NSS / NCC / Sports / Department Activity	I – VI semesters	2
2.	**Competence Enhancement :** Add-on Course / Women's Studies / Extra paper	I – VI semesters	2
		Grand Total	**148**

14STU01 **DESCRIPTIVE STATISTICS** **Semester: I**

OBJECTIVE: To be able to understand the purpose of descriptive Statistics and to strengthen the knowledge in basic Statistics.

UNIT:I
Hours:12

Origin and Scope – Functions, Limitations, Uses and misuses of Statistics. Collection of Data, Primary and secondary Data – Census and Sampling – Sampling Techniques. Classification and Tabulation of data – Diagrammatic and Graphical representation of data – Simple problems.

UNIT:II **Hours:08**

Measures of Central tendency – Measures of Dispersion – Relative measures of Dispersion. Merits and demerits.

UNIT:III **Hours:14**

Simple Linear Correlation and Regression – Definition – Karl Pearson's Correlation coefficient – Spearman's rank Correlation - Properties – Regression equations – Differences between Correlation and Regression.

UNIT:IV **Hours:12**

Probability space – Statistical Probability – Axiomatic approach to Probability – addition and multiplication theorems – Conditional probability – Baye's theorem – Simple problems.

UNIT:V **Hours:14**

Random variables – Discrete and Continuous random variables – Distribution function and Probability Function – Mathematical Expectation – Theorems on Mathematical Expectation – evaluation of standard measures of location, Dispersion. Skewness and Kurtosis – Simple problems.

REFERENCE:

1. Kapoor V.K. and Gupta S.C. : Fundamentals of Mathematical Statistics
2. Gupta SP : Statistical Methods

14STU02 **MATRICES** **Semester: I**

OBJECTIVE: To develop methods and tools to tackle multiple natural hazards within a common frame work.

Unit I
Hours:14

Finite Matrices over the Complex Number System – Elementary, Scalar, Hermitian, Skew – Hermitian, Symmetric, Skew – Symmetric, Unitary, Equivalent and Similar Matrices – Transpose and Conjugate of a Matrix.

Unit II **Hours:10**

Determinant of a Square Matrix, Properties of a Determinant – Cramer's rule – Evaluation of Inverse of Non – Singular Matrix by Adjoint, Sweep out Methods.

Unit III
Hours:14

Rank of a matrix – Determination of Rank – Inverse - Elementary Transformations – Matrix representation of a set of linear equations and their solvability – Homogenous and Non – Homogenous equations.

Unit IV **Hours:08**

Characteristic roots and Characteristic vectors of a square matrix – Cayley - Hamilton theorem, Matrix Polynomial.

Unit V **Hours:14**

Vector Space – Definition of Vector Space over Complex Number field – Concepts of subspace basis and dimension – Linear dependence and Independence – Linear transformation –Quadratic forms – Matrix of Quadratic form – positive definite and Semi definite – Simple problems.

REFERENCE:

1. Vasista - Matrices.
2. Sharma & Vasista - Matrices.
3. Saxena & Sharma - Theory of Matrices.
4. Khanna M.L - Matrices.
5. Chatterji P.N - Matrices.
6. Gupta SC - An Introduction to Matrices
7. Sasthri - Numerical Mathematic

14STU03 / 14PHU03 / 14CHU02

Mathematics I (Allied)
(For BSc Statistics, Physics and Chemistry)

Unit I

Theory of Equations: Relation Between Roots and Coefficients-Solving Equations When Roots are in A.P,G.P,H.P and When Relations Between Roots are Given With Simple Conditions-Diminishing the Roots by a Constant 'h'-Solving Reciprocal Equations.

Unit II

Curvature: Radius of Curvature, Centre of Curvature, Evolutes and Involutes (Cartesian Co-ordinates Only)

Unit III

Integral Calculus : Properties of Definite Integrals- Reduction Formulae - Beta and Gamma Functions.

Unit IV

Multiple Integrals: Double and Triple Integrals.

Unit V

Trigonometry: Expansions of $\sin n\theta$, $\cos n\theta$, $\tan n\theta$, $\sin^n\theta$, $\cos^n\theta$-Infinite Series of $\sin\theta$, $\cos\theta$, $\tan\theta$ in Powers of - Hyperbolic Functions.

Text Book:

"Ancillary Mathematics" Volume I and II by **S. Narayanan, R.Hanumantha Rao, and T.K. Manicavachagam Pillay,** S. Viswanathan Printers and Publishers. 2007

Unit I : Chapter 2 : (Volume I)

Unit II : Chapter 6 : Section 6.4 (Volume I)

Unit III : Chapter 1 : Sections 1.11 to 1.15 (Volume II)

Unit IV : Chapter 3 : (Volume II)

Unit V : Chapter 5 : Sections 5.1 to 5.3 (Volume I)

14STU04 **NUMERICAL METHODS** **Semester: II**

OBJECTIVE: Need to break the complicated problems to simple mathematical problems through the Numerical methods and acquire practical knowledge in the real application field.

UNIT I **Hours:13**

Operator E, D & Δ and their properties – Fundamental theorem of finite difference separations of symbols – Estimating one and two missing values – Newton's forward and backward formulae of Interpolation – Newton's divided difference formula – Lagrange's formula – Problems.

UNIT II
Hours:12

Central difference formulae of interpolation – Gauss, Bessel's, Sterling's and Everett's formulae. Concept of inverse interpolation – Lagrange's inverse interpolation

formula – problem.

UNIT III
Hours:14

Numerical Differentiation – Formulae for numerical differentiation – First and Second order derivatives. Numerical Integration – Quadratic formula – Trapezoidal rule – Simpsons $1/3^{rd}$ and $3/8^{th}$ rule, Weddle's rule, Euler Maclaurin's formula, Sterling's approximation to n! – Simple Problems.

UNIT IV **Hours:10**

Solution of Algebraic & Trancendental equation – Regula false method, Newton Raphson Method, Horner's method, Iteration method.

UNIT V
Hours:11

Numerical solution of ordinary differential equations. Introduction – Euler's method, solution by Taylor's series – Runge-Kutta method (second order only) - Predictor and Corrector methods – Milne's method – problems.

REFERENCE:

1. Goel BS and Mittal SK : Numerical Analysis
2. Scarborough BJ : Numerical Mathematical Analysis
3. Balasubramanian : Numerical Mathematics.
4. Sasthri - Numerical Mathematics

14STU05 TIME SERIES AND INDEX NUMBERS Semester: II

OBJECTIVES: Students should be able to understand the basic forecasting models and to

acquire practical experience in analyzing the time series data.

UNIT I **Hours:14**

Concept of Time Series – Components of a time series – additive and multiplicative models – resolving the components of a time series – Least square method – Fitting of linear trend – Method of moving averages – effect of moving average on other components.

UNIT II
Hours:14

Seasonal Indices – Simple average, Ratio to moving average, Ratio to trend, Link relative Method – Cyclical fluctuations – Residual method only – Random components – Variate difference Method.

UNIT III
Hours:12

Basic Index numbers and their definitions –Construction of wholesale price index numbers and uses – Fixed and Chain base index numbers – Unweighted and Weighted index numbers.

UNIT IV
Hours:10

Laspeyer's, Paasche's, Fisher's, Kelly's and Marshall Edgeworth index numbers - Tests for ideal index numbers, Cost of living index number – Construction and uses.

UNIT V
Hours:10

National Income – Estimation Methods – Uses of National Income Estimate – Computational difficulties in India.

REFERENCE:

1. Gupta .SC & Kapoor.VK : Fundamentals of Applied Statistics.
2. Goon .AN Gupta & Das Gupta MK. : Fundamentals of Statistics
3. Sharma .KK : Statistics
4. Elhance .DA : Fundamentals of Statistics.
5. Croxton & Cowden .DJ : Applied General Statistics

14STU06 / 14PHU06 / 14CHU05

Mathematics II (Allied)

(For BSc Statistics, Physics and Chemistry)

Unit I

Matrices: Evaluation of eigen values and eigen vectors – Cayley Hamilton Theorem – Diagonalization.

Unit II

Partial Differential Equations: Formation of Partial Differential Equations – General Integral, Particular Integral and Complete Integral – Standard Forms – Largrange's Form of Linear First Order Equations

Unit III

Fourier Series: Full Range and Half Range Series – Development in Cosine Series – Development in Sine Series (Except Harmonic Analysis).

Unit IV

The Laplace Transform: Inverse laplace transform – Solving ordinary differential equations by laplace transform.

Unit V

Solving Simultaneous Linear Equations by Gauss Elimination – Gauss Jordan – Gauss Jacobi – Gauss Seidal Method.

Text Book:

1."Ancillary Mathematics" Volume I and II by **S. Narayanan, R.Hanumantha Rao, and T.K. Manicavachagam Pillay,** S. Viswanathan Printers and Publishers. 2007
(For Units I, II, III & IV)

2."**Numerical Methods in Science and Engineering**" by **Dr.M.K.Venkataraman**. The National Publishing Company. Fifth Edition. August 2004.
(For Unit V)

Unit I : Chapter 3 : Sections 3.4, 3.5 (Volume I)

Unit II : Chapter 6 : Sections 6.1 to 6.6 (Volume II)

Unit III : Chapter 2 : Sections 2.1 to 2.5 (Volume II)

Unit IV : Chapter 7 : Sections 7.1 to 7.4 (Volume II)

Unit V : Chapter 4 : Sections 1 to 3, 6 (Text Book 2)

14STU07 STATISTICS PRACTICAL – I Semester:II

OBJECTIVE: To develop the skills in Applying the Statistical tools in various fields.

UNIT I
Hours:10

Matrices – Algebraic Operations – Rank of a Matrix – Inverse of a Matrix – Solving the system of linear equations involving 2 and 3 variables – Characteristic roots and vectors.

UNIT II
Hours:10

Formation of Univariate and Bivariate Frequency Distributions –Computation of averages : Mean – Median – Mode – Harmonic Mean – Geometric Mean. Computation of Measures of Dispersion – Quartile Deviation – Mean Deviation – Standard Deviation – Coefficient of Variation

UNIT III
Hours:09

Moments – Skewness – Kurtosis – Correlation – Rank Correlation.

UNIT IV
Hours:09

Regression – Index Number – Unweighted and Weighted Index Numbers – base shifting Cost of living Index Numbers. Fitting of Straight Line - Fitting of Curves of the form, $Y = a+bx+cx^2$, $Y = ae^{bx}$ and $Y = ab^x$.

UNIT V
Hours:10

Time Series – Methods of Measuring Trend – Moving Average Method – Method of Least Squares – Seasonal Indicies – Method of Simple Averages – Method of Link Relatives – Ratio to trend, Ratio to Moving Average - Variate difference method.

14STU08 **REAL ANALYSIS** **Semester: III**

Objective: To enable the students to gain sufficient knowledge in mathematical analysis.

UNIT – I **Hours: 14**

Sequence of real numbers – limiting point of a sequence – limit of a sequence – convergent – divergent, bounded and monotone sequences, Cauchy's first and second theorems on limit, Cauchy's general principle of convergence – Operations on sequences – limit superior and limit inferior for sequence of sets – Cauchy sequence – subsequences.

UNIT – II **Hours: 10**

Series of real numbers, convergence and divergence of series with non- negatives terms – comparison test – p test, D' Alembert's ratio test, Cauchy's root test, Raabe's test. Alternating series, conditional and absolute convergence – Leibnitz test.

UNIT – III **Hours: 11**

Limit of real valued function in one variable - Continuity – types of discontinuities – algebra of continuous functions - derivability of a real valued function in one variable - algebra of derivatives – Rolle's Theorem – Cauchy's mean value theorem – Taylor's theorem – Simple applications.

UNIT – IV **Hours: 13**

Fundamental theorem of integral calculus – First and Second mean value theorems – improper integrals – necessary and sufficient conditions for the convergence of the improper integral – practical comparison test – A useful comparison test – absolute convergence – Simple problems.

UNIT – V **Hours: 12**

Gamma integral – Beta integrals of first and second kind – their properties – simple problems. Multiple integrals – Dirichilet's theorem and Dirichilet's extension theorem (concept only) – Jacobian transformation of variables – Simple problems.

REFERENCE:

1. Shanthi Narayan : A course of Mathematical Analysis
2. Goldberg : Methods of Real Analysis
3. Ranjit Singh and Arora : Introduction to Real Analysis
4. Apostol : Mathematical Analysis
5. Mallik and Arora : Mathematical Analysis
6. Rudin - Mathematical Analysis

14STU09 **PROBABILITY DISTRIBUTIONS** **Semester: III**

Objectives: To understand the application of various distribution and acquire practical knowledge in identifying the type of distribution in the real life problems.

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UNIT – I **Hours:12**

Moment Generating Function – Definition of Characteristic Function (No problems) – Tchebyshev's inequality – Weak Law of Large Numbers – Bernoulli's law of large numbers – Simple problems – Statement of Central limit theorem for i.i.d random variables.

UNIT – II **Hours:12**

Bivariate distributions – Independence of two random variables – Marginal and Conditional distributions – Marginal and Conditional expectations, Conditional variance.

UNIT – III **Hours:12**

Definition - recurrence relation - MGF and additive properties of Binomial and Poisson distributions – limiting case of Poisson distribution – Definition - Negative Binomial, Geometric and Hypergeometric distributions – Multinomial Distribution –Definition and its moments. Derivation of mean and variance of the above distribution.

UNIT – IV **Hours:12**

Definition, derivation of mean and variance of Rectangular, Beta (first and second kind), Gamma and Exponential distributions – Limiting case and additive property of Gamma distribution, Normal distribution – Definition – MGF – additive property and its limiting case- properties (Statement only)

UNIT – V **Hours:12**

Definition - Application and derivation of t, F and χ^2 distributions – relationship between t, F and χ^2 distributions.

REFERENCE:

1. Kapoor and Saxena : Mathematical Statistics
2. Gupta SC & Kapoor VK : Fundamental of Mathematical Statistics
3. Hogg RV & Craig : Introduction to Mathematical Statistics
4. Bansilal : Introduction to Mathematical Statistics

14ECU03/14MAU03 ACCOUNTANCY - I/ACCOUNTANCY (ALLIED)

14STU10 Semester -I/III

(For B.A Economics , BSc Mathematics , BSc Statistics)

Learning objective: To learn the Principles and Practices of Accountancy.

	Hours
UNIT I Accounting Concepts and Conventions	(EC) 14
Accounting Definition – Objectives - Uses and Limitations -Principles Concepts and Conventions – Journal – Ledger- Trial Balance.	(MA) 8 (ST) 12
UNIT II Subsidiary Books	(EC) 14
Purchase Book - Sales Book - Purchase Returns Book - Sales Returns Book - Bills Payable Book - Bills Receivable Book- Cash Book- Double Column, Triple Column Cash Book – Petty Cash Book.	(MA)10 (ST) 12
UNIT III Bank Reconciliation Statement and Rectification of Errors	(EC) 14
Bank Reconciliation Statement – Debit Balance - Over Draft Balance, Rectification of Errors - Suspense Account.	(MA)10 (ST) 12
UNIT IV Final Accounts	(EC) 15
Final Accounts of Sole Trading Concerns – Trading Account – Profit and Loss Account – Balance Sheet – Adjustment Entries.	(MA)10 (ST) 12
UNIT V Average Due Date and Account Current	(EC) 15
Average Due Date - Account Current –Various Methods of Calculation of Interest – Red Ink Entry.	(MA)10 (ST) 12

Distribution of Marks: 80% Problems and 20% Theory .

Text Book

1. Grewal .T.S, "Introduction to Accountancy" ,S.Chand and Co.Ltd, New Delhi .

Reference Books

1. Gupta R.L and Radhaswany.M, "Advanced Accountancy", Sultan chand and Son's, New Delhi.
2. Jain.S.P, Narang.K.L, "Advanced Accountancy", Kalayani Publishers, New Delhi .

14STU11 **STATISTICAL INFERENCE – I** **Semester: IV**

Objective: Acquire knowledge in estimating the parameters and draw a valid inference about a population parameter.

UNIT – I **Hours:12**

Concept of Parametric Estimation – Unbiasedness, Consistency, Efficiency and Sufficiency of an estimator – Cramer Rao Inequality – MVB estimator.

UNIT – II **Hours:12**

Asymptotic efficiency of an estimator – estimators based on sufficient statistics – Neyman's factorization theorem (without proof) – Rao Blackwell theorem.

UNIT – III **Hours:13**

Methods of estimation – Moments, Maximum Likelihood, Minimum and modified minimum Chi – Square methods – properties of estimators obtained by those methods (without proof).

UNIT – IV **Hours:11**

Concept of sampling distributions – standard error and its uses. Concept of interval estimation – Confidence intervals – derivation of Confidence interval based on normal, t, F and χ^2 distributions. Bayes estimation – prior and posterior distribution (Concepts only).

UNIT – V **Hours:12**

Concept of order Statistics – Distribution of the lowest, highest and range of the observations (without proof). Non-parametric tests -Sign, Median, Run and U tests, Wilcoxon's Signed Rank test (without proof) - χ^2 test for goodness of fit.

REFERENCE:

1. Goon AM, Gupta M and Das Gupta B: An out line of Statistical Theory
2. Hogg RV and Graig AG : Introduction to Mathematical Statistics
3. Mood and Graybill : Introduction to Theory of Statistics
4. Gupta &V.K.Kapoor : Fundamentals of Mathematical Statistics
5. Ramaswamy M M : Theory and Applications of Statistics

14STU12 **BASIC SAMPLING THEORY** **Semester: IV**

Objective: Students should recognise the possible pitfalls in published data and understand the need for randomness and the desirability of stratification in sampling.

UNIT – I **Hours: 12**

Population – Complete Enumeration - Sample – Sampling from finite population – Sample Survey - Advantage and Disadvantage of Sample survey – sampling unit – frame, Sampling and Non-Sampling errors – Principal steps in a sample survey.

UNIT – II **Hours: 12**

Simple random sampling – SRSWR and SRSWOR – Unbiased estimate of mean and variance of population – Population total – SRS for proportions – Estimation of Sample Size.

UNIT – III **Hours: 13**

Stratified Random Sampling – Unbiased estimates for population mean and total, variance of estimated mean allocation – Proportional and Optimum Allocation – Comparison of stratified and simple random sampling – Stratified Sampling for Proportions.

UNIT – IV **Hours: 12**

Systematic Sampling – Estimation of Mean – Variance of Estimated Mean – Comparison of Systematic with Stratified Random Sampling – Population with Stratified Random Sampling – Population with Linear Trend.

UNIT – V **Hours: 11**

Cluster Sampling – Two Stage Sampling with respect to SRS – Ratio Estimators – Variance of the Ratio estimate Concept of Regression estimators.

REFERENCE:

1) Cochran. W.G. - Sampling Theory.
2) Gupta. S.C and Kapoor V.K - Fundamentals of Applied Statistics.
3) Murthy. M.N - Sampling Theory and Techniques.
4) Chowdhary and Darogesingh - Theory and Analysis of SampleSurvey Designs.
5) Desraj - Sampling Theory
6) Sampath S - Sampling Theory

14STU13 **MATHEMATICAL ECONOMICS** **Semester: IV**
(Allied)

Objective: To enlighten the students with the knowledge in Mathematical Economics and to enhance their skills in problem solving in Economics.

UNIT – I **Hours:12**

Introduction to Economics and economic laws – scope of mathematical methods in economics – theory of demand – demand function – demand curve – Elasticity of demand – revenue function – average and marginal revenue – normal conditions of demand.

UNIT – II **Hours:12**

Consumer's equilibrium – Utility approach to consumer's equilibrium – Limitation – Scale of Preference – Indifference Curve approach – Income and Substition effects – Slutsky's equation.

UNIT – III **Hours:12**

Cost Function and Cost Curves – Average and Marginal Cost Curves – Cost Elasticity and Normal Cost Conditions – Short term and long term Cost Curves – Consumer's and Producer's Surplus.

UNIT – IV **Hours:12**

Concept of Market Equilibrium – Input and Output models - Fixation under perfect competition – Monopoly – Discriminating Monopoly – Duopoly.

UNIT – V **Hours:12**

Production function – constant product curves – laws of returns and returns to scale. Marginal rates of substitution – expansion path – elasticity of substitution.

REFERENCE:

1. Agarwal : Mathematics Approach to Economics.
2. Allen R.G.D : Mathematical Analysis for Economist.
3. Mehtha and Madhamani : Mathematics for Economics.
4. Goel and Saxena : Mathematics Economics.

14STU14 **STATISTICS PRACTICAL – II** **Semester: IV**

Objective: To enhance the skills in the application of Statistics.

Fitting of distributions of Binomial, Poisson and Normal and tests for their goodness of fit.
Estimation of parameters of the distribution by the methods of moments and maximum likelihood with regard to Binomial, Poisson, Multinomial and Normal distributions.
Confidence intervals based on Normal, t, F and χ^2 distributions.
Numerical problems involving derivation of marginal and conditional probability density functions and related measures of location and dispersion. Non- parametric test- sign test, median test, Run test and Mann – Whitney U Test and Wilcoxon Signed Rank test.

14STU15 **STATISTICAL INFERENCE – II** **Semester: V**

Objectives: To impart knowledge about the hypothesis and testing their significances on various situations..

UNIT- I **Hours: 12**

Testing Statistical hypothesis – Fundamental concepts and definitions based on Neyman and Pearson approach – Neyman and Pearson Fundamental lemma – Most powerful tests based on NP lemma – Unbiased tests - Simple problems.

UNIT- II **Hours: 12**

Uniformly most powerful test criterion – Simple problems- Likelihood ratio criterion – LR Method for testing the mean and variance of normal populations(Single and double sample only) – Simple Problems.

UNIT- III **Hours: 12**

Concept of tests of significance- Asymptotic tests with regard to proportion , means, standard deviations and correlation coefficients. Exact tests based on student's t-distribution with regard to means, correlation coefficients, regression coefficients and partial correlation coefficients.

UNIT- IV **Hours: 12**

Exact tests based on F and Chi-square distribution with regard to multiple correlation co-efficient and variances – Tests for the homogeneity of several variances.

UNIT V **Hours: 12**

Association of attributes – Conditions for consistency and independence of attributes – Yule's coefficient of association and coefficient of colligation – Simple problems. Contingency tables – Test for independence of attributes.

REFERENCE:

1. Hogg and Craig : Introduction to mathematical Statistics
2. Mood and Graybil : Introduction to theory of Statistics
3. Goon, Gupta & Das Gupta : Outline of Statistical Theory
4. Surender and Saxena : Statistical Inference
5. Gupta S.C and Kapoor V.K : Fundamentals of Mathematical Statistics
6. M.Rajagopalan : Statistical Inference

14STU16 **EDUCATIONAL & PSYCHOLOGICAL STATISTICS** **Semester: V**

Objectives: To develop the skills in Applying the Statistical tools in Psychology.

UNIT – I **Hours: 10**

Rank difference correlation – Limits, Biserial Correlation – The point biserial – Significance, Tetrachoric r – Significance, Partial and multiple correlation – Multiple regression equations (for three variables only).

UNIT – II **Hours: 12**

Scaling individuals test of difficulty, Scaling of Scores on a test, Z scaling, Z- scores, Standard Scores, Normalized Scores – T scores for ungrouped and grouped data.

UNIT – III **Hours: 13**

Scaling of judgment, scaling of rating in terms of normal curve. Stannine scale and C scale for grouped and ungrouped data.

UNIT – IV **Hours: 15**

Reliability of Test Scores – Index of reliability, Methods of determination of reliability - Test – Retest Method, Parallel form method, Split half Method, Rational equivalence – Effect of test length on the reliability of the test, Lengthening of a test to attain a desired reliability.

UNIT – V **Hours: 10**

The validity of test scores, determining validity by judgments – Test for Validity and Reliability – Comparison of reliability and validity.

REFERENCE:

1. Guil Ford and : Fundamental Statistics in Psychology Education

2. Garret Henry : Statistics in Psychology and Education

3. Gupta & Kapoor : Fundamentals of Applied Statistics.

14STU17 **STATISTICAL QUALITY CONTROL – I** **Semester: V**

Objective: To introduce the concept and its application to industrial statistics for the students.

UNIT – I **Hours: 12**

Quality of a product, need for quality control, Basic concepts of Process control, Process capability and product control – Importance of Statistical methods in industrial research and Practice – benefits, Specification of items under lot quality corresponding to Visual gauging, Process control and Product Control.

UNIT – II **Hours: 12**

Acceptance Sampling for attributes – Problem of lot acceptance, Good and bad lots. Producer's Risk and Consumer's Risk – Single Sampling Plan, Double Sampling Plan – Derivation of OC, AOQ, ASN and ATI Curves.

UNIT – III **Hours: 12**

Acceptance sampling for variables- Advantages and disadvantages – Assumptions – Derivation of n and k for known & unknown σ Plans.

UNIT – IV **Hours: 12**

Normal Reduced and Tightened Plans (Concepts) - Sequential Sampling Plans – Derivation of OC, ASN, ATI Curves.

UNIT – V **Hours: 12**

Just in time manufacturing and waste elimination approach – JIT methods – Elements of JIT – Kanban system – Implementation, objectives and Benefits of JIT – Concept of Six Sigma.

REFERENCE:

1. Ekambaram S.K. : Statistical Basis of Acceptance sampling
2. Dunkan A.J. : Quality Control and Industrial Statistics
3. Grant E.L : Statistical Quality Control
4. Gupta S.C. and. Kapoor V.K : Fundamental of Applied Statistics
5. Gupta R.C. : Statistical Quality Control

CORE ELECTIVE-I

14STU18 **OPERATIONS RESEARCH – I** **Semester: V**

Objectives: To gain knowledge on the various OR techniques in decision making and problem solving.

UNIT – I **Hours: 12**

Definition and Scope of Operations Research –Types of models – Phases of Operations Research. General linear programming problems- Mathematical formulation of a LPP – Graphical solution of a LPP.

UNIT – II **Hours: 13**

Concepts of slack, surplus and artificial variables – Simplex method and Big M Method, concept of degeneracy, Two Phase Method.

UNIT – III **Hours: 13**

Concept of Duality – Formulations of Primal – Dual problems – Dual simplex method of solving a LPP. Integer programming: Gomory's Constraints- Solution of IPP.

UNIT – IV **Hours: 12**

Transportation problem: Introduction – Obtaining an initial basic feasible solution by North West corner rule, Row minima, column minima, matrix minima method and Vogel's Approximation method – Optimality – Concept of degeneracy –MODI method- simple problems.

UNIT – V **Hours: 10**

Assignment problem: Introduction - Solving the problem. (Hungarian method): Sequencing problem of n jobs and two machines, n jobs and three machines and n jobs and m machines.

REFERENCE :

1. Sharma JK : Operations Research

2. Kothari : Operations Research

3. Prakasam K : Operations Research

4. Sharma SD : Operations Research

6. Kanti Swarup Manmohan and Gupta PK : Operations Research

7. Gupta PK and Hira DS : Operations Research and Quantitative Analysis

14STU19 **BIG DATA ANALYTICS** **Semester :V**

OBJECTIVES: This paper educate students to a foundation level on big data and the state of the practice of analytics.

UNIT-I

INTRODUCTION TO BIG DATA ANALYTICS

Definition and an overview of BIG DATA – the state of practice of analytics – the data scientist role and BIG DATA analytics in industry verticals

UNIT-II

OVERVIEW OF DATA ANALYTICS LIFE CYCLE

Various phases of a typical analytics life cycle – discovery – data preparation – model planning – model building – communicating results and findings and operationalizing.

UNIT-III

USING R FOR INTIAL ANALYSIS OF THE DATA

Introduction to R programming – initial exploration and analysis of the data using R and basic visualization using R.

UNIT-IV

ADVANCED ANALYTICS AND STATISTICAL MODELLING FOR BIG DATA

Naïve Bayesian classifier – categorization using K – means clustering and association rules – predictive modeling using a decision trees.

UNIT-V

Linear, Multiple and logistics regression – time series analysis – text analysis.

BOOKS FOR STUDY AND REFERENCE:

1. Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses Hardcover - Michael Minelli, Michele Chambers and Ambiga Dhiraj

2. Big Data Analytics: Turning Big Data into Big Money Hardcover - Frank J. Ohlhorst
3. Understanding Big Data: Analytics for Enterprise Class Hadoop and Streaming Data - Dirk deRoos, Chris Eaton, George Lapis, Paul Zikopoulos, Tom Deutsch

14EDCSTU **ELEMENTS OF STATISTICS – EDC** **Semester: V**

(Cluster – II)

Objectives: To create statistical Knowledge among the Non - Statistics students.

Unit – I

Statistical Investigation – Sampling Theory – Types of sampling – Probability & Non-Probability sampling – Data -Primary- Secondary data – Methods of Data collection.

Unit-II

Classification &Tabulation Univariate distribution – Measures of Central tendency

– Measures of dispersion – Skewness.

Unit - III

Bi – variate distribution – Correlation – Types - Methods – Rank correlation –Regression – Methods of regression – Difference between correlation and Regression – Simple Problems.

Reference Books:

1. Statistical Methods : S.P.Gupta, Sultan Chand & Co
2. Statistics : RSN. Pillai & Bagavathi
3. Business Mathematics and Statistics : PA Navneetham

14STU20 **DEMOGRAPHIC METHODS** **Semester: VI**

Objectives: To have a theoretical knowledge in vital statistics and to get a practical knowledge in estimating population growth.

UNIT – I **Hours: 12**

Source of Demographic data – Vital Registration – Population census – Population Register – Demographic Surveys – Population data as an aid to social, Economic and health planning – process of Indian Civil Registration and census

UNIT – II **Hours: 11**

Fertility measurements, Fertility as a component of population change – Crude Birth Rate – General and Age specific Fertility Rate – Gross and Net reproduction Rates and their interpretation.

UNIT – III **Hours: 10**

Mortality measurements, Crude death rate – Infant Mortality Rate – Age, Sex, and cause specific death rates – Force of mortality rates – Gompertz and Makeham's laws.

UNIT – IV **Hours: 12**

Description and construction of various columns of a life table – Uses of a life table – Migration and Distribution – Gross, Net, Mobility and Migration – rates – interpretation of spatial distribution of population.

UNIT – V **Hours: 15**

Population Projection – Components of population change and growth – Population estimates and projection – Arithmetic, geometric and Exponential growth rates – Logistic curve – Basic ideas of stationary and stable populations.

REFERENCE:

1. Srivatsava : Studies in Demography
2. Gupta S.P : Statistical Methods
3. Gupta S.C. & Kapoor V. K : Fundamentals of Applied Statistics
4. Benjamin B : Elements of Vital Statistics

14STU21 **DESIGN OF EXPERIMENTS** **Semester: VI**

Objectives: To impart the knowledge about the various design concepts in the field experiments.

UNIT – I **Hours: 15**

Fundamental Principles of Experimentation – Analysis of Variance – One way and Two way classification – Two way classification with many observations per cell (Balanced case only).

UNIT – II **Hours: 15**

Principles of Design of Experiments – Analysis of different experiments CRD – RBD – LSD – Relative efficiency – Missing plot Techniques (Single observation).

UNIT – III **Hours: 08**

Factorial Experiments – Analysis of 2^2, 2^3 and 2^4 Factorial Experiments.

UNIT – IV **Hours: 11**

3^2-Experiments involving two factors each at three levels – concepts of confounding – Analysis of 2^3 confounding design- Concept of Partial confounding – Partial confounding in 2^3experiments.

UNIT – V **Hours: 11**

Analysis of Covariance with one concomitant variable – Application of Covariance techniques in RBD- BIBD – Split-plot Design (concepts only)

REFERENCE:

1. Cochran & Cox : Experimental Design

2. Kempthorne O. : Design of Analysis of Experiments

3. Gupta SC & Kapoor V.K : Fundamentals of applied statistics

4. Goon Gupta & Das Gupta : Fundamentals of Statistics

5. Montgomery : Design of Experiments

14STU22 **STATISTICAL QUALITY CONTROL – II** **Semester: VI**

Objectives: To impart knowledge among the students on Statistical process control concepts.

UNIT – I **Hours: 12**

Basis of Total Quality – Evaluation and Definition of quality – Need for Quality improvement – TQM definition – Fundamentals of TQM – TQM Models. ISO 9001:2000 (E) series with reference to process control and statistical techniques

UNIT – II **Hours: 10**

Statistical process control – Concept of SPC – Failure model effect – Data collection and analysis for SPC. Variable Control charts – X – bar, R and σ charts.

UNIT – III **Hours: 12**

Control charts for attributes – np, p, c and u charts – OC curves. Process capability – Process capability index, interpreting process capability index – Statistical control chart – SPC and quality improvement.

UNIT – IV **Hours: 14**

Process capability – Process capability index, interpreting process capability index – SPC and quality improvement.

UNIT – V **Hours: 12**

Reliability – Need and Definition – Concept of Hazard rate – Concept of IFR and DFR – Failure distributions – Cumulative Hazard rate, constant failure rate – Relevance of Exponential distribution in reliability.(one parameter only)

REFERENCE:

1. Mohanty ; Lakhe : Hand Book of total quality management

2. Zaidi : Statistical process control concepts, methodologies and Tools

3. Bala Guruswamy E. : Reliability Engineering

4. Singaporewalla : Reliability and Inference

5. Sharma .D : Total quality management principles, practice and Cases

6. Douglas. C. Montgomery : Introduction to statistical Quality control

CORE ELECTIVE-II

14STU23 **OPERATIONS RESEARCH – II** **Semester: VI**

Objectives: To enhance and strengthen the conceptual as well as practical skills of various techniques of Operations Research.

UNIT – I **Hours: 12**

Introduction to Two person zero-sum Games. Maxmin, Minimax Principles, Games without saddle points – mixed strategies. Graphical solution to 2xn and mx2 Games- Dominance property and modified Dominance property. Reducing the Game problem in to an LPP.

UNIT – II **Hours: 12**

Introduction – Replacement of items that deteriorate with time, Replacement of items whose maintenance costs increase with time and the value of money remains same during the period Replacement of items whose maintenance costs increase and the value of money also changes with time – Replacement of items that fails completely – Individual and Group replacement policies.

UNIT – III **Hours: 12**

Introduction: Simulation – Elements of a Simulation model, Event – Type of simulation, Generation of Random numbers Monte – Carlo technique, Generation of Uniform (0, 1) random observations, Simulation languages - problems.

UNIT – IV **Hours: 12**

Introduction – Queueing system, Characteristics of Queueing system – The input process, queue discipline. The service mechanism, the capacity of the system, service channels. The M/M/1 Queue system (M/M/1:∞/ FIFO)- (M/M/1:N/ FIFO). (M/M/C: ∞/ FIFO).

UNIT – V **Hours: 12**

Introduction – Network Analysis – Basic concepts, Activities, nodes, critical path method– construction of Network, time calculations in networks, Critical Path calculations. PERT– PERT calculations. Float – types of floats.

*** Note: Questions on numerical problems shall constitute 75% of the total marks. No derivations.**

REFERENCE:

1. Arkotf et. Al : Fundamentals of Operation Research.

2. Kanti Swarup et. Al. : Operations Research

3. Taha : Operations Research

14STU24 **ECONOMETRICS** **Semester: VI**

Objectives: To develop the skills in applying the Statistical tools in Economics.

UNIT - I **Hours: 10**

Economic models and their uses in Economic Theory – Structure and model – Exogenous and Endogenous variables – Stochastic and non- stochastic models, Linear, Non-linear, static, Dynamic, Micro models.

UNIT - II **Hours: 15**

Multiplier and accelerator principles – Static and Dynamic multipliers – Marginal propensity to consume – Harrod and Domar Models of Economic growth – Cobweb model.

UNIT - III **Hours: 12**

Leontief's Input – Output analysis – Assumptions – Closed and Open I/O models – simple problems.

UNIT - IV **Hours: 10**

Econometrics - Definitions – Scope – Objectives and limitations – Two variables linear model and testing methods – Concept of Economic forecasting.

UNIT - V **Hours: 13**

Concepts of multicollinearity – Auto Correlation – Hetroscedasticity – Tests for Auto – Correlation – specification error – Concept of dummy variables.

REFERENCE:

1. Agarwal : Text book of Econometrics
2. Johnston . J : Econometric methods
3. Sankaran : Macro Economics
4. Singh S. P : Econometrics
5. Kotsoyinnis : Econometrics

14STU25 **STATISTICS PRACTICAL – III** **Semester: VI**

Objective: To develop the skills in the application of the Statistical tools in various fields.

Analysis of Variance – One-way and Two-way classifications. Two-way classification with one concomitant variable.

Analysis of CRD, RBD, and LSD layouts.

Missing plot techniques in RBD and LSD (one & two observations only) Analysis of 2^3, 2^2 and 2^3 factorial designs without confounding.

Control charts for attributes and variables - x,R,P, np, and C charts.

Single sampling attributes OC, ATI, ASN, AOQ curves. Determination of partial and multiple correlation coefficients. Multiple linear regression lines.

Construction of complete life tables – Determination of mortality, fertility and reproduction rates – fitting of logistics curves to population data by Peal and Read and Rhodes methods.

Standard asymptotic and exact test of significance with regards to Mean, Variance, coefficient of Correlation, Regression coefficient, partial and multiple correlation coefficients – Independence test for contingency table of order PxQ – Test of homogeneity of several variances.

Estimation of Mean and Variance of population- the Variance of the estimate of the mean using SRS, stratified random sampling – Estimation of mean and variance under proportional and optimum allocation, systematic sampling- estimation of mean and variance-comparison of variances.

14STU26 **COMPUTER BASED STATISTICS PRACTICAL(SPSS)** **Semester: VI**

Objective: To learn the computation of statistical tools using SPSS.

Introduction - Sample files – Opening a Data file – Running an Analysis – viewing Results – Creating Charts – Multiple Response (define variable sets) – Transform (Recode into same variable, Recode into different variable).Selected Cases, Split file.

Graph (Bar, Line, Dot, Pie Charts) - Descriptive Statistics (Frequency, Descriptive, Crosstabs) – Compare Means (One-Sample t-test, Independent-Sample t-test, Paired-Sample t-test, One-Way ANOVA) – Correlation (Bivariate, Partial) – Regression (Linear, Non-linear).

Reliability – Scale Parameter.