**STATISTICS ANCILLARY SYLLABUS**

**(W.E.F. the session 2014-15)**

| Semester | Paper Code | Marks | Credits | Topic |
|---|---|---|---|---|
| 1 | ST21012T | 70 | 4 | Descriptive Statistics 1 & Probability Theory 1 |
| | ST21012P | 30 | 1 | Practical- Using Minitab software |
| **2** | ST22022T | 70 | 4 | Descriptive Statistics 2 & Probability Theory 2 |
| | ST22022P | 30 | 1 | Practical- Using Minitab software |
| **3** | ST23032T | 70 | 4 | Sampling distribution & Statistical Inference 1, Sample Survey & Statistical Inference 2 |
| | ST23032P | 30 | 1 | Practical- Using Minitab software |

**Semester: I**

**Semester: I**
**Paper Code: ST21012T**
**Group: A( Module 1)**
**Topic: Descriptive Statistics – 1**
**Lecture hrs: 26**

Introduction to Statistics. Population and sample. Data: Primary and secondary data, Non-frequency and frequency data. Scales of measurement. Tabulation. Graphical representation of non-frequency data: line, bar, pie and component bar diagram. Frequency distribution .Graphical representation of frequency distributions: column diagram, histogram, step diagram and ogive. (3L)

Analysis of univariate data: concepts of central tendency, dispersion, skewness and kurtosis and their measures with properties and applications. A.M.- G.M. and Cauchy- Schwarz inequality (Statement only). Box-plot. (13L)

Analysis of bivariate data: Scatter plot. Correlation and Linear regression. (10L)

**References:**
A.M. Gun, M.K. Gupta and B. Dasgupta : Fundamentals of Statistics (Vol. 1).

**Course Objective:** At the end of the semester, the student should have a clear concept regarding:
i) Classification and Collection of data
ii) Presentation and Analysis of Univariate and Bivariate data.

**Paper Structure:**

| No of Ques to be set | | No of Ques to be answered | | Marks | Marks | Total marks |
|---|---|---|---|---|---|---|
| Short | long | short | Long | (short ques) | (long ques) | |
| 5 | 2 | 3 | 1 | 5x3=15 | 15x1=15 | **30** |

**Semester: I**
**Paper Code: ST21012T**
**Group: A (Module 2)**
**Topic: Probability Theory – 1**
**Lecture hrs: 26**

Random experiment. Sample space and events. Operations with events. Classical definition of probability and its limitations. Theorem on union of mutually exclusive events. Poincare`s theorem. Boole`s and Bonferroni`s inequality. Conditional probability. Theorem of compound probability. Baye`s Theorem. Independence of events. Frequency and Axiomatic definition of probability (16 L)

Random variable and probability distribution. Cumulative distribution function. Probability mass function and Probability density function. Moment and quantile measure of central tendency, dispersion, skewness and kurtosis (concepts only). (10 L)

**References:**


1. A.M. Gun, M.K. Gupta and B. Dasgupta : Fundamentals of Statistics (Vol. 1).
2. Hogg and Craig: Introduction to Mathematical Statistics.
3. Ross : A First Course in Probability.


**Course Objective:** At the end of this course a student

1) Should have an intuitive appreciation of the chance of occurrence of events.
2) Should be able to objectively quantify the chance of occurrence of events using the laws of probability.
3) Should have an idea about a random variable and its probability distribution.
4) Should be able to connect the concerned theories to real life situations.

**Paper Structure:**

| No of Ques to be set | | No of Ques to be answered | | Marks | Marks | Total marks |
|---|---|---|---|---|---|---|
| Short | long | short | Long | (short ques) | (long ques) | |
| 5 | 2 | 3 | 1 | 5x3=15 | 15x1=15 | **30** |

**Semester: I**
**Paper Code: ST21012P**
**Group: B**
**Topic: Practical based on topics in Group A using MINITAB software.**
**Marks: 20**

**Semester: II**
**Paper Code: ST22022T**
**Group: A (Module 1)**
**Topic: Descriptive Statistics – 2**
**Lecture hrs: 26**

Non Linear Regression : Polynomial and Exponential. Correlation Index and Related Results. [7L]

Rank Correlation : Spearman's and Kendall's Coefficients. [6L]

Analysis of Categorical Data : Contingency Tables. Association and Independence. Measures for 2x2 Tables – Odds Ratio, Gamma measure for ordinal data. Measure for kxl contingency tables – Pearsonian $\chi^2$. [6L]

Analysis of Trivariate Data : Multiple Linear Regression, Multiple Correlation and Partial Correlation. Related Results. [7L]

**References:**
A.M. Gun, M.K. Gupta and B. Dasgupta : Fundamentals of Statistics (Vol. 1)

**Course Objective:** At the end of this course a student would learn
(i) Non-linear Regression and linear regression with multiple predictors
(ii) Different measures of association when both variables are ordinal, both nominal, one ordinal and one nominal.

**Paper Structure:**

| No of Ques to be set | | No of Ques to be answered | | Marks | Marks | Total marks |
|---|---|---|---|---|---|---|
| Short | long | Short | Long | (short ques) | (long ques) | |
| 5 | 2 | 3 | 1 | 5x3=15 | 15x1=15 | **30** |

**Semester: II**
**Paper Code: ST22022T**
**Group: A (Module 1I)**
**Topic: Probability Theory – 2**
**Lecture hrs: 26**

Univariate Distributions – Binomial, Hypergeometric and Poisson Distributions. Rectangular, Normal, Exponential and Gamma Distributions. [12L]

Joint Distribution of Two Random Variables – Marginal and Conditional Distributions. Independence. Expectation of the Sum and Product of two random variables. Correlation coefficient. Variance of the sum of two random variables. Simple Problems. [7L]

Bivariate Normal Distribution and Statement of its Properties. [2L]

Chebyshev's Inequality, Weak Law of Large Numbers and Central Limit Theorem for iid random variables. Statements and Illustrations. [5L]

**References:**


1. A.M. Gun, M.K. Gupta and B. Dasgupta : Fundamentals of Statistics (Vol. 1).
2. Hogg and Craig: Introduction to Mathematical Statistics.
3. Ross : A First Course in Probability.


**Course Objective:** At the end of the course a student should

1. Know the genesis of different discrete and continuous distributions
2. Know the characteristics of different discrete and continuous distributions.
3. Be able to apply these distributions appropriately.
4. Understand different aspects of Bivariate normal distribution.
5. Know probability inequalities and limit theorems.

**Paper Structure:**

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|---|---|---|---|---|---|---|
| Short | Long | short | Long | (short ques) | (long ques) | |
| 5 | 2 | 3 | 1 | 5x3=15 | 15x1=15 | **30** |

**Semester: II**
**Paper Code: ST22022P**
**Group: B**
**Topic: Practical based on topics in Group A using** MINITAB software.
**Marks: 20**

**Semester: III**
**Paper Code: ST23032T**
**Group: A (Module 1)**
**Topic: Sampling Distribution & Statistical Inference 1**
**Lecture hrs: 26**

**Sampling Distribution :** Concepts of : Random Sample, Parameter & Statistic, Sampling Fluctuation & Sampling Distribution, Standard Error. Sampling Distributions arising out of Normal Population – $\chi^2$, t, F (definition & statement of important properties). Joint Distribution of sample mean & sample variance in case of normal population (statement only). [6]
**Theory of Point Estimation :** Estimator, Bias & Mean Square Error. Unbiasedness & Minimum Variance. Consistency-statement of sufficient conditions. Methods of Point Estimation – Method of Moments & Method of Maximum Likelihood. [10]

**Theory of Interval Estimation :** Confidence Interval & Confidence Coefficient. Confidence Interval for mean & variance of a normal population and difference of means & ratio of variances of two independent normal populations. [4]

**Analysis of Variance :** Analysis of one way & two way classified data (one observation per cell)- Fixed Effects Model. [6]
**References:**

1. A.M. Gun, M.K. Gupta and B. Dasgupta : Fundamentals of Statistics (Vol. 1&2).
2.Hogg and Craig: Introduction to Mathematical Statistics.

**Course Objective:** After completion of the course a student should know

(i) A hypothetical population and Sampling distributions of functions of random variables drawn from a specified hypothetical population.
(ii) The theory of Point Estimation: Criteria for a good estimator.
(iii) How to estimate the parameters of the hypothetical population by method of moments and likelihood method.
(iv) How to set up confidence intervals for mean and variance of normal population.
(v) Analysis of variance technique.

**Paper Structure:**

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|---|---|---|---|---|---|---|
| Short | long | short | Long | (short ques) | (long ques) | |
| 5 | 2 | 3 | 1 | 5x3=15 | 15x1=15 | **30** |

**Semester: III**
**Paper Code: ST23032T**
**Group: A (Module 1I)**
**Topic: Sample Survey & Statistical Inference-II**
**Lecture hrs: 26**

**Sample Survey :** Concepts of random sampling from a finite population. Simple Random Sampling with & without replacement. Estimators of Population Mean, Total & Proportion – standard error & its estimator. [6]

**Testing of Hypothesis :** Null & Alternative Hypotheses. Simple & Composite Hypotheses. Test Statistic & Critical Region. Type I & Type II errors. Level of significance. Power & Size. Tests for mean & variance of a normal population. Tests for difference of means & ratio of variances of two independent normal populations. Tests for the significance of correlation coefficient, difference of means & ratio of variances of a Bivariate Normal population. [12]

**Large Sample Tests :** Tests for binomial proportions and Poisson means for single and two independent populations . Pearsonian $\chi^2$ and its uses – Goodness of fit (parameters specified & unspecified), Test of independence in Contingency Tables. [8]

**References:**


1. A.M. Gun, M.K. Gupta and B. Dasgupta : Fundamentals of Statistics (Vol. 1&2).
2. Hogg and Craig: Introduction to Mathematical Statistics.


**Course Objective:** At the end of the semester, a student should have learnt to :

(i) Conceptualize simple random sampling
(ii) Conceptualize Testing of Hypothesis as a branch of statistical inference.
(iii) Frame a hypothesis and the test procedure in real life problems
(iv) How to modify the test procedures in case of large samples.

**Paper Structure:**

| No of Ques to be set | | No of Ques to be answered | | Marks | Marks | Total marks |
|---|---|---|---|---|---|---|
| Short | long | short | Long | (short ques) | (long ques) | |
| 5 | 2 | 3 | 1 | 5x3=15 | 15x1=15 | **30** |

**Semester: II**

**Paper Code: ST23032P**
**Group: B**
**Topic: Practical based on topics in Group A using** MINITAB software.
**Marks: 20**