आज दिनांक 17.11.2011 को विश्वविद्यालय परिसर में निम्न विषय की पाठ्यक्रम समिति की एक आवश्यक बैठक हुई, जिसमें निम्न प्राध्यापकों उपस्थित हुए :-

Date :- 17.11.2011 Subject :- Statistics Committee Place :- Central Library

1. Dr. Mukesh chnadra
2. Dr. Subra Katara
# Unified Syllabus of Statistics

<table>
<thead>
<tr>
<th>Course</th>
<th>Instruction</th>
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</thead>
<tbody>
<tr>
<td>B.Sc. Part- I &amp; Part - II</td>
<td>There will be three papers of 3 hours duration of 50 marks in each. Practical will be of 50 marks &amp; three hour duration in each year.</td>
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<tr>
<td>B.A Part- I &amp; Part - II</td>
<td>There shall be two theory papers of three hour duration of 33 marks each. Practical will be of 34 marks &amp; three hour duration in each year.</td>
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<tr>
<td>B.Sc Part-III</td>
<td>There will be three theory papers of three hour duration &amp; 75 marks each. Practical would be of 75 marks &amp; three hour duration.</td>
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<tr>
<td>B.A Part - III</td>
<td>There will be three theory paper of three hour duration &amp; 35 marks each. Practical would be of 45 marks &amp; three hour duration.</td>
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UNIFIED SYLLABUS OF STATISTICS
B.A. Part- I

Paper – I : Probability & Probability Distribution

UNIT – I
Random experiment, trial, sample point and sample space, events, operations of events, concepts of equally likely, mutually exclusive and exhaustive events.

Definition of probability : Classical, relative frequency and axiomatic approaches. Discrete probability space, properties of probability under set theoretic approach Independence of events, Conditional probability, total and compound probability theorems, Bayes theorem and its applications.

Random variables – discrete and continuous, probability mass function (pmf) and probability density function (pdf), Cumulative distribution function (cdf).

UNIT – II
Joint distribution of two random variables, marginal and conditional distributions, Independence of random variables. Expectation of a random variable (rv) and its properties, expectation of sum of random variables and product of independent random variables, conditional expectation and related problems. Moments, moment generating function (m.g.f.) & their properties, continuity theorem for m.g.f. (without proof).Chebyshev’s inequality. Weak law of large numbers and Central Limit Theorem for a sequence of independently and identically distributed random variables and their applications.

UNIT – III

UNIT – IV
Distributions of function of random variables: Distribution of sum, product and quotient of two variables. Reproductive property of standard distributions. $\chi^2$ (chi-square), t and F distributions (Central cases only) and their limiting forms. Bivariate normal distribution and its properties.

REFERENCE:
UNIFIED SYLLABUS OF STATISTICS
B.A. Part-I

Paper – II : Statistical Methods and Numerical Analysis

UNIT-I

UNIT-II
Bivariate data, Method of least squares for curve fitting. Correlation and regression, rank correlation (Spearman’s and Kendall’s measure). Intra-class correlation, correlation ratio. Partial and Multiple Correlation & Multiple Regression for Tri-variate data.

UNIT – III
Attributes- Notion and terminology, contingency table, class frequencies, and ultimate class frequencies, consistency. Association of attributes, Independence, Measure of association for 2x2 table. Chi-square, Karl Pearson’s and Tschuprow’s coefficient of association. Contingency tables with ordered categories.

UNIT – IV

REFERENCES
3. Freeman : Finite Differences.
B.A. Part-I

PRACTICAL

The practical examination will be based on papers I and II and will cover the following experiments.

List of Practical Experiments
1. Graphical representation of data by Histogram, Frequency polygons, frequency curves and Ogives, stem & Leaf Plot, Box Plot.
2. Calculation of measures of location.
3. Calculation of measures of dispersion.
4. Calculation of moments, measures of skewness and measures of Kurtosis.
5. Fitting of curves by method of least squares.
6. Determination of regression lines and calculation of correlation coefficient – grouped and ungrouped data.
7. Calculation of multiple and partial correlation coefficients for three variables
8. Calculation of measures of association in contingency tables.
9. Construction of forward difference tables and divided difference tables.
10. Interpolation by Newton’s forward difference formula for equal intervals and calculation of error.
11. Interpolation by Newton’s divided difference formula for unequal intervals.
12. Interpolation by Lagrange’s formula for unequal intervals.
13. Approximate integration (Trapezoidal rule, Simpson’s one-third rules, Simpson’s three-eighth rule), Weddle’s rule.
Paper I : Statistical Inference & Analysis of variance

UNIT – I

UNIT – II

UNIT – III
Neyman-Pearson’s lemma and its applications for finding most powerful tests for simple hypothesis against simple alternative. Tests based on t, F and $\chi^2$ distributions. Likelihood ratio tests and their reduction to standard tests. Large sample tests. Interval estimation, Pivotal quantity and its use in finding confidence intervals, concept of best confidence intervals.

UNIT – IV
Analysis of Variance. One way classification. Assumptions regarding model. Two way classification with equal number of observations per cell. Duncan’s multiple comparison test. Analysis of covariance.

REFERENCE
UNIFIED SYLLABUS OF STATISTICS
B.A. Part- II

Paper II : Survey Sampling & Design of Experiments

UNIT – I

Stratified random sampling. Problem of allocation, proportional allocation, optimum allocation. Derivation of the expressions for the standard errors of the usual estimators when these allocations are used. Gain in precision due to stratification. Role of sampling cost in the sample allocation. Minimization of variance for fixed cost. Systematic sampling: estimation of population mean and population total, standard errors of these estimators.

UNIT-II

UNIT-III

UNIT-IV
Missing plot technique ; estimation of missing plots by minimizing error sum of squares in RBD and LSD with one or two missing observations. Factorial Experiments : general description of
factorial experiments; $2^2$, $2^3$ and $2^n$ factorial experiments arranged in RBD and LSD. Definition of main effects and interactions in $2^2$ and $2^3$ factorial experiments. Preparation of ANOVA by Yates procedure. Estimates and tests for main and interaction effects (Analysis without confounding).

**REFERENCES**

4. Cochran and Cox : Experimental Design
5. Kempthorne : Design of Experiments
6. Federer : Experimental Designs

**B.A. Part- II**

**PRACTICAL**

The practical examination will be based on papers I and II will cover the following experiments:

**List of Practical Experiments**

1. Fitting of Binomial, Poisson and Normal distributions to observed data and testing of goodness of fit.
2. Testing of independence of attributes in m x n contingency table and calculation of measures of association.
3. $t$ – test for (i) $\mu = \mu_0$ (ii) $\mu_1 = \mu_2$ (iii) $\alpha = \alpha_0$ (iv) $\beta = \beta_0$ (v) $\rho = 0$
4. F-test for $\sigma_1^2 = \sigma_2^2$
5. Fisher’s Z-transformation and its use in testing (i) $\rho = \rho_2$ (ii) $\rho = \rho_0$
6. Calculation of power curve for the test of $\mu = \mu_0$ against $\mu \neq \mu_0$ for a normal distribution with known variance.
7. Large sample tests.
8. Analysis of variance in one-way and two-way classification (with and without interaction terms).
10. Analysis of variance in RBD and LS design with one or two missing observations.
11. Drawing a simple random sample with the help of table of random numbers.
13. Stratified random sampling for population mean (proportional and optimum allocation).
15. Factorial Experiment Practical.
Paper – I : Probability

UNIT – I
Random experiment, trial, sample point and sample space, events, operations of events, concepts of equally likely, mutually exclusive and exhaustive events.

Definition of probability: Classical, relative frequency and axiomatic approaches. Discrete probability space, properties of probability under set theoretic approach. Independence of events, Conditional probability, total and compound probability theorems, Bayes theorem and its applications.

UNIT – II
Random variables – discrete and continuous, probability mass function (pmf) and probability density function (pdf), Cumulative distribution function (cdf). Joint distribution of two random variables, marginal and conditional distributions.

UNIT – III
Independence of random variables. Expectation of a random variable (rv) and its properties, expectation of sum of random variables and product of independent random variables, conditional expectation and related problems.

UNIT – IV
Moments, moment generating function (m.g.f.) & their properties, continuity theorem for m.g.f. (without proof). Chebyshev’s inequality. Weak law of large numbers and Central Limit Theorem for a sequence of independently and identically distributed random variables and their applications.

REFERENCE:
UNIFIED SYLLABUS OF STATISTICS

B.Sc. Part- I

**Paper – II : Probability distributions and Numerical Analysis**

**UNIT – I**


**UNIT – II**

Distributions of function of random variables: Distribution of sum, product and quotient of two Variable. Reproductive property of standard distributions. χ²(chi-square), t and F distributions (Central cases only) and their limiting forms. Bivariate normal distribution and its properties.

**UNIT – III**

Calculus of finite differences, operators, separation of symbols, examples and problems. Interpolation formulas with remainder term. Newton’s forward and backward formulae. Central difference formulae, Newton’s divided difference formulae for interpolation. Lagrange’s interpolation formulae

**UNIT – IV**

Numerical Integration: Derivation of general quadrature formula for equidistant ordinates. Derivation of trapezoidal, Simpson’s 1\(^{st}\) and 3\(^{rd}\) and 3\(^{rd}\) rules. Weddle’s rule. Numerical differentiation using Newton’s forward and backward formulae.

**REFERENCES**

3. Freeman: Finite Differences.
7. Saxena, H.C : Calculus of Finite Differences (S. Chand & Co.).
Paper III Statistical Methods:

UNIT-I
Concept of statistical population, Attributes and variables (discrete and Continuous). Different types of scales – nominal, ordinal, ratio and interval. Primary data – designing a questionnaire and schedule, collection of primary data, checking their consistency. Secondary data. scrutiny of data for internal consistency and detection of errors of recording. Presentation of data : classification, tabulation, diagrammatic & graphical representation of grouped data. Frequency distributions, cumulative frequency distributions and their graphical representations, histogram, frequency polygon and ogives. Stem and Leaf plot. Box Plot.

UNIT-II

UNIT-III
Correlation and regression, rank Correlation ( Spearman’s and Kendall’s measure), Intra-class correlation, correlation ratio. Partial and Multiple Correlation & Multiple Regression for Tri-variate data.

UNIT-IV
Attributes- Notion and terminology, contingency table, class frequencies, and ultimate class frequencies, consistency. Association of attributes, Independence, Measure of association for 2x2 table. Chi-square, Karl Pearson’s and Tschuprow’s coefficient of association. Contingency tables with ordered categories.

REFERENCES:
B.Sc. Part- I

PRACTICAL

The practical examination will be based on papers I, II & III and will cover the following experiments.

List of Practical Experiments
1. Graphical representation of data by Histogram, Frequency polygons, frequency curves and Ogives. Stem and Leaf Plot, Box Plot.
2. Calculation of measures of location.
3. Calculation of measures of dispersion.
4. Calculation of moments, measures of skewness and measures of Kurtosis.
5. Fitting of curves by method of least squares.
6. Determination of regression lines and calculation of correlation coefficient – grouped and ungrouped data.
7. Calculation of multiple and partial correlation coefficients for three variables
8. Calculation of measures of association in contingency tables.
9. Construction of forward difference tables and divided difference tables.
10. Interpolation by Newton’s forward difference formula for equal intervals and calculation of error.
11. Interpolation by Newton’s divided difference formula for unequal intervals.
12. Interpolation by Lagrange’s formula for unequal intervals.
13. Approximate integration (Trapezoidal rule, Simpson’s one-third rules, Simpson’s three-eighth rule), Weddle’s rule.
Paper I : Statistical Inference

UNIT – I

UNIT – II
Sufficient Statistics, Cramer-Rao inequality and its use in finding MVU estimators. Statistical Hypothesis (simple and composite). Testing of hypothesis. Type I and Type II errors, significance level, p-values, power of a test. Definitions of Most Powerful (MP), Uniformly Most Powerful (UMP) and Uniformly Most Powerful Unbiased (UMPU) tests.

UNIT – III
Neyman-Pearson’s lemma and its applications for finding most powerful tests for simple hypothesis against simple alternative. Tests based on t, F and $\chi^2$ distributions.

UNIT-IV
Likelihood ratio tests and their reduction to standard tests. Large sample tests. Interval estimation, Pivotal quantity and its use in finding confidence intervals, concept of best confidence intervals.

REFERENCE
Paper II : Survey Sampling

UNIT – I

UNIT-II
Stratified random sampling. Problem of allocation, proportional allocation, optimum allocation. Derivation of the expressions for the standard errors of the usual estimators when these allocations are used. Gain in precision due to stratification. Role of sampling cost in the sample allocation. Minimization of variance for fixed cost. Systematic sampling : estimation of population mean and population total, standard errors of these estimators.

UNIT-III
Regression and ratio methods of estimation in simple random sampling. Cluster sampling with equal clusters. Estimators of population mean and their mean square error.

UNIT-IV
Double sampling in ratio method of estimation. Two-stage sampling with equal first stage units : estimator of population mean and its variance. Non-sampling errors.

REFERENCES
UNIFIED SYLLABUS OF STATISTICS

B.Sc. Part- II

Paper III : Analysis of Variance and Design of Experiment.

UNIT-I
Analysis of Variance. One way classification. Assumptions regarding model. Two way classification with equal number of observations per cell. Duncan’s multiple comparison test. Analysis of covariance.

UNIT-II
Principles of Design of experiments: Randomization, Replication and local control. Choice of size and type of a plot using uniformity trials. CRD, Randomized block design. Concept and definition of efficiency of design. Comparison of efficiency between CRD and RBD.

UNIT – III
Latin square Design, Lay-out, ANOVA table. Comparison of efficiencies between LSD and RBD; LSD and CRD. Missing plot technique: estimation of missing plots by minimizing error sum of squares in RBD and LSD with one or two missing observations.

UNIT-IV
Factorial Experiments: general description of factorial experiments; $2^2$, $2^3$ and $2^n$ factorial experiments arranged in RBD and LSD. Definition of main effects and interactions in $2^2$ and $2^3$ factorial experiments. Preparation of ANOVA by Yates procedure. Estimates and tests for main and interaction effects (Analysis without confounding).

REFERENCES
1. Cochran and Cox : Experimental Design
2. Kempthorne : Design of Experiments
3. Federer : Experimental Designs
5. Das & Giri : Design and Analysis of Experiments (Wiley Eastern).
B.Sc. Part- II

PRACTICAL

The practical examination will be based on papers I, II and III and will cover the following experiments:

List of Practical Experiments

1. Fitting of Binomial, Poisson and Normal distributions to observed data and testing of goodness of fit.
2. Testing of independence of attributes in m x n contingency table and calculation of measures of association.
3. t – test for (i) $\mu = \mu_0$ (ii) $\mu_1= \mu_2$ (iii) $\alpha = \alpha_0$ (iv) $\beta= \beta_0$ (v) $\rho= 0$
4. F-test for $\sigma_1^2 = \sigma_2^2$
5. Fisher’s Z-transformation and its use in testing (i) $\rho_1 = \rho_2$ (ii) $\rho =\rho_0$
6. Calculation of power curve for the test of $\mu = \mu_0$ against $\mu \neq \mu_0$ for a normal distribution with known variance.
7. Large sample tests.
8. Analysis of variance in one-way and two-way classification (with and without interaction terms).
10. Analysis of variance in RBD and LS design with one or two missing observations.
11. Drawing a simple random sample with the help of table of random numbers.
13. Stratified random sampling for population mean (proportional and optimum allocation).
15. Factorial Experiment Practical.
UNIFIED SYLLABUS OF STATISTICS
B.A. & B.Sc. Part- III

Paper 1 : Non-parametric Methods and Regression Analysis

UNIT – I
Multivariate normal distributions, marginal and conditional distribution, Moment Generating and Characteristics functions, Maximum likelihood estimation of mean vector and co-variance matrix, independence and joint sufficiency of these estimates. Distribution of linear combination of components of multi normal variate.

UNIT – II
Order Statistics. Distributions of minimum, r\textsuperscript{th} and maximum order statistic. Joint distribution of r\textsuperscript{th} and s\textsuperscript{th} order statistics (in continuous case) Distribution of sample range & sample median, for uniform and exponential distributions. Confidence interval of quantiles of order p.

UNIT – III

UNIT – IV
Linear regression model of full rank, Least squares theory. Estimation of parameters-OLSE and MLE of \( \beta \) and test of hypotheses. \( R^2 \) and adjusted \( R^2 \). ANOVA table for regression,

REFERENCE :
2. Gibbons, J.D. : Non-parametric statistical inference
5. Johnston : Econometric Methods
6. Anderson : Introduction to Multivariate Statistical Analysis, Chaps 1,2 & 3
Paper II : Applied Statistics

UNIT – I

Time series, its different components, illustrations, additive and multiplicative models, determination of trend, growth curves, analysis of seasonal fluctuations, construction of seasonal indices. Idea of Correlogram & periodogram.

Index number – its definition, application of index number, price relative and quantity or volume relatives, link and chain relative, problem involved in computation of index number, use of averages, simple aggregative and weighted average method. Laspeyre’s, Paashe’s and Fisher’s index number, time and factor reversal tests of index numbers, consumer price index

UNIT – II

Educational Statistics: Scaling procedures – scaling of test items, test scores, rating of qualitative answers and judgements. Test theory, linear models, parallel tests, true score, reliability and validity of tests. Tetra-choric, bi-serial and point bi-serial correlation coefficients.

UNIT – III


UNIT – IV

Control charts for variables and attributes, modified control charts, group control charts, CUSUM charts, V mask. Sampling inspection by attributes – single and double sampling plans. Producer’s and consumer’s risk, OC, ASN, ATI functions AOQL and LTPD of sampling plans. Sampling inspection by variables – simple cases.

REFERENCE :
2. Draper & Smith : Applied Regression Analysis
4. Wetherill and Brown : Statistical Quality Control
Paper III : Operations Research

UNIT – I

UNIT – II
Replacement problems (individual and group). Queueing Models – M/M/1, M/M/C models waiting time distribution for M/M/1, Little’s formulae. M/G/1 Queueing system, cost profit models in queueing theory.

UNIT – III
Project Management : PERT/CPM determination of floats construction of time chart and resources labelling.

UNIT – IV
Inventory Models : FOQ models, Non-zero, land time, EOQ with shortages allowed.

REFERENCES :

PRACTICALS :
Based on Paper I, Paper II and Paper III.
Recommendation

It is resolved to implement the new as such from the current session 2011-12.