BANGALORE UNIVERSITY

Regulations and Syllabus
for
STATISTICS
in
Three Year BSc Course (CBCS 2017)

Eligibility

1. Only those candidates who have passed Pre-University course or an equivalent course with Mathematics/Business Mathematics/Basic Mathematics/Applied Mathematics as one of the optional subjects are eligible to take Statistics as one of the optional subjects in BSc course.

2. Any student taking Statistics as one of the optional subjects in the B.Sc. course shall take Mathematics as another optional subject.

Scheme of Instruction/Examination

1. The subject of Statistics in this course has to be taught by MSc/MA degree holders in Statistics/Applied Statistics.

2. The theory question paper for each paper shall cover all the topics in the pertaining syllabus with proportional weightage to the number of hours of instruction prescribed.

3. The practicals are to be conducted in batches as per the University norms for the faculty of science (normally 10 students per batch per teacher).

4. Two teachers are to be assigned for each batch with not more than 20 students for giving instructions, supervision, and correction of records.

5. It is expected that each student collects and uses real life data for the practical classes.

6. Students are required to use Statistical software, run the programmes, and enclose computer outputs to the practical records in the case of computer based practicals.

7. Maximum marks for each record in the examination is 5.

8. Study tour for the students is strongly recommended to gain practical knowledge of applications of Statistics in Industries/Agriculture/Medical field.
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<thead>
<tr>
<th>Sem.</th>
<th>Code number</th>
<th>Title of the paper (Theory / Practical)</th>
<th>Lecture/Practical hours per week</th>
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<td>Basic Statistics-I</td>
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<td>Sampling Theory and Statistical Quality Control</td>
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Total credits: 24
STATISTICS

FIRST SEMESTER

4 hours lecture + 3 hours practical per week
(Theory 2 credits + Practical 1 credit)

ST 101: BASIC STATISTICS – I

(52 hours : 2 credits)

Unit 1
Organization and presentation of data: Meaning, importance, and scope of Statistics. Types of data: Primary and secondary data. Types of measurements: Nominal, ordinal, ratio, and interval. Classification and tabulation. Construction of frequency distribution. Graphical representation: Frequency curve, Ogives, histogram. 8 hrs

Unit 2
Univariate data analysis: Measures of location: Arithmetic mean, median, mode, geometric mean, harmonic mean, and their properties. Quantiles: quartiles, deciles, percentiles. Absolute and relative measures of dispersion: range, standard deviation, mean deviation, quartile deviation, coefficient of variation and their properties. Moments: Raw and central moments, properties, and relationship between them. Skewness and kurtosis: concept, measures, and properties. 16 hrs

Unit 3
Bivariate data analysis: Bivariate data, Scatter diagram, Correlation, Karl Pearson’s correlation coefficient, Spearman’s rank correlation coefficient. Concept of errors, Principle of least squares. Simple linear regression and its properties. Fitting linear regression line and coefficient of determination. 10 hrs

Unit 4
Multivariate data analysis: Multiple linear regression, multiple and partial correlation coefficients. Residual error variance. Coefficient of determination. 6 hrs

Unit 5

ST 102: PRACTICAL – I

List of Assignments

(30 hours : 1 credit)

(Demonstration using MS Excel)

1. Construction of frequency distribution and graphical representation.
2. Measures of central tendency I
4. Measures of dispersion (Range, QD, MD, SD, and CV).
5. Moments, skewness, and kurtosis for a frequency distribution.
6. Correlation and regression for ungrouped data and Spearman’s rank correlation coefficient.
7. Correlation and regression for grouped data
8. Analysis of trivariate data.
10. Application of addition rule, conditional probability, Bayes formula.

Text Books

References
STATISTICS

SECOND SEMESTER

4 hours lecture + 3 hours practical per week
(Theory 2 credits + Practicals 1 credit)

ST 201: BASIC STATISTICS – II

(52 hours : 2 Credits)

Unit 1
Random variables and expectation (Univariate): Distribution function, Discrete and continuous random variables, Probability mass and density functions- properties and illustrations. Expectation of a random variable and algebra of expectations and related results. Moments and moment generating function, properties and applications. Transformation of random variables.

Unit 2
Discrete probability distributions: Discrete uniform, Bernoulli, binomial, Poisson, geometric, negative binomial, and hypergeometric distributions – mean, variance, moments, and MGF. Recursive relations for moments of binomial and Poisson distributions. Approximations of binomial, negative binomial and hypergeometric distributions.

Unit 3
Continuous probability distributions: Uniform, gamma, beta, exponential, Normal, and Cauchy distributions – mean, variance, moments, MGF, and properties.

Unit 4

Unit 5

ST 202: PRACTICAL –II

List of Assignments

(Demonstration using MS Excel and R software)

1. Univariate probability distributions: Expectation, moments, skewness, and kurtosis.
2. Bivariate probability distributions: Moments and correlation coefficient.
3. Applications of binomial distribution and fitting binomial distribution.
5. Computation of probabilities based on negative binomial, geometric, hyper geometric and discrete uniform distributions.
6. Applications of Normal distribution.
7. Fitting normal distribution.
8. Computation of probabilities based on rectangular and exponential distributions.
9. Applications of Chebyshev’s inequality.
10. Applications of the central limit theorem.

Text Books


References

STATISTICS

THIRD SEMESTER

4 hours lecture + 3 hours practical per week
(Theory 2 credits + Practicals 1 credit)

ST 301: STATISTICAL INFERENCE - I

(52 hours : 2 credits)

Unit 1

10 hrs

Unit 2

20 hrs

Unit 3

6 hrs

Unit 4
Interval estimation: Confidence interval, confidence coefficient, shortest confidence interval. Method of constructing confidence intervals using pivotal quantity. Construction of confidence intervals for mean, difference of two means, variance and ratio of variances, proportion, difference of two proportions, and correlation coefficient.

8 hrs

Unit 5

8 hrs

ST 302: PRACTICAL III

List of Assignments

(Demonstration using MS Excel and R Software)

1. Drawing random samples using random number tables.
2. Point estimation of parameters and obtaining estimates of standard errors.
3. Comparison of estimators by plotting mean square error.
4. Computing maximum likelihood estimates - 1
5. Computing maximum likelihood estimates - 2
6. Computing moment estimates
7. Constructing confidence intervals based on large samples.
8. Constructing confidence intervals based on small samples.
9. Generating random samples from discrete distributions.
10. Generating random samples from continuous distributions.

Text Books


References

STATISTICS
FOURTH SEMESTER
4 hours lecture + 3 hours practical per week
(Theory 2 credits + Practicals 1 credit)

ST 401: STATISTICAL INFERENCE - II
(52 hours : 2 credits)

Unit 1

Unit 2
Tests of significance I: Large and small sample tests of significance. Tests for single mean, equality of two means, single variance, and equality of two variances for normal populations. Tests for proportions. 12 hours

Unit 3
Tests of significance II: Tests for simple, partial, and multiple correlation coefficients and regression coefficients. Fisher’s Z-transformation and its applications. Analysis of categorical data: contingency tables, tests for the independence and association of attributes. Chi-square tests for independence of attributes and goodness of fit. 12 hrs

Unit 4
Nonparametric tests: Introduction to nonparametric tests. Run test for randomness. Sign test and Wilcoxon signed rank test for one and paired samples. Run test, median test, and Mann-Whitney-Wilcoxon test for two sample problems. Test for independence based on Spearman’s rank correlation coefficient. 10 hrs

Unit 5
Sequential tests: Need for sequential tests, Wald’s SPRT for binomial proportion and Normal population mean when variance is known. 6 hrs

ST 402: PRACTICAL – IV
List of Assignments
(30 hours : 1 credit)
(Demonstration of practicals using MS-Excel)

1. Evaluation of probabilities of Type-I and Type-II errors and powers of tests.
2. MP test for parameters of binomial and Poisson distributions.
3. MP test for the mean of a normal distribution and power curve.
4. Tests for mean, equality of means when variance is (i) known, (ii) unknown
under normality (small and large samples)
5. Tests for single proportion and equality of two proportions.
6. Tests for variance and equality of two variances under normality
7. Tests for correlation and regression coefficients.
8. Tests for the independence of attributes, analysis of categorical data and tests for the
goodness of fit. (For uniform, binomial and Poisson distributions)
9. Nonparametric tests.
10. SPRT for binomial proportion and mean of a normal distribution.

Text Books


References

STATISTICS

FIFTH SEMESTER

6 hours of lecture + 6 hours of practical per week
(Theory: 4 credits + Practicals: 2 credits)

ST 501: SAMPLING THEORY AND STATISTICAL QUALITY CONTROL

(39 hours : 2 credits)

Unit 1

Unit 2

Unit 3
Linear systematic sampling, its advantages and limitations. Estimation of mean, total and variance of the estimators. Comparison with SRSWOR. Circular systematic sampling.

Unit 4

Unit 5
Product control: Lot acceptance sampling- Sampling inspection, 100 percent inspection and rectifying inspection. AQL, LTPD, Producer’s risk and consumer’s risk. Acceptance sampling plans – single and double sampling plans by attributes- Derivation of OC, AOQ, ASN, and ATI, functions.
ST 502: PRACTICAL – V

List of Assignments

(30 hours : 1 credit)

1. Drawing of random sample under SRSWR and SRSWOR from a given population and estimation of the mean and total and the standard errors of the estimators. Construction of confidence intervals.
2. Estimation of the proportion, total, and the standard errors of the estimators based on a random sample under SRSWR and SRSWOR.
3. Stratified random sampling.
4. Systematic sampling.
5. $\bar{X}$ – R charts. (Standard values known and unknown).
6. $\bar{X}$ – s charts. (Standard values known and unknown).
7. np and p charts. (Standard values known and unknown).
8. c and u charts. (Standard values known and unknown).
10. Drawing OC, AOQ, ASN, and ATI curves for double sampling plan.

Text Books


References


ST 503: DESIGN AND ANALYSIS OF EXPERIMENTS

(39 hours : 2 credits)

Unit 1

Analysis of variance: Meaning and assumptions. Fixed, random and mixed effect models. Analysis of variance of one-way and two-way classified data with and without interaction effects. Multiple comparison tests: Tukey’s method, critical difference.

10 hrs
Unit 2
Experimental designs: Principles of design of experiments. Completely randomized, randomized block, and Latin square designs (CRD, RBD, and LSD) -layout formation and the analysis using fixed effect models. 10 hrs

Unit 3
Efficiency of a design and missing plot technique: Comparison of efficiencies of CRD, RBD, and LSD. Estimation of single missing observation in RBD and LSD and analysis. 5 hrs

Unit 4
Factorial experiment: Factorial experiment: Basic concepts, main effects, interactions, and orthogonal contrasts in $2^2$ and $2^3$ factorial experiments. Yates’ method of computing factorial effects total. Analysis and testing the significance of effects in $2^2$ and $2^3$ factorial experiments in RBD. 8 hrs

Unit 5
Confounding: Need for confounding. Complete and partial confounding in a $2^3$ factorial experiment in RBD - layout and its analysis. 6 hrs

ST 504: PRACTICAL – V
List of Assignments
(Demonstration of practicals using MSEexcel)

1. ANOVA for one way classified data.
2. ANOVA for two way classified data.
3. Analysis of CRD.
4. Analysis of RBD.
5. Analysis of LSD.
6. Missing plot techniques in RBD and LSD.
7. Analysis of $2^2$ factorial experiment using RBD layout.
8. Analysis of $2^3$ factorial experiment using RBD layout.
9. Analysis of $2^3$ factorial experiment using RBD layout. (Complete confounding)
10. Analysis of $2^3$ factorial experiment using RBD layout. (Partial confounding)

Text Books

References
ST 601: APPLIED STATISTICS

**Unit 1**

8 hrs

**Unit 2**

7 hrs

**Unit 3**

10 hrs

**Unit 4**

7 hrs

**Unit 5**

7 hrs

**ST 602: PRACTICALS - VII**

**List of Assignments**

3. Construction of index numbers and consumer price index numbers.
4. Tests for consistency of index numbers.
8. Clinical trials 1: (Odds ratio, relative risk, and confidence interval)
9. Clinical trials 2: (ROC curve and computation of various rates)

Text Books


References


ST 603: OPERATIONS RESEARCH

(39 hours : 2 Credits)

Unit 1


Unit 2


Mathematical formulation of assignment problem and Hungarian algorithm. Unbalanced assignment problem. 8 hrs
Unit 3


5 hrs

Unit 3

Inventory and replacement theory: Description of an inventory system. Inventory costs. Demand, lead time, and reorder level. Inventory models. EOQ model with and without shortages.


8 hrs

Unit 5

Queuing theory: Characteristics of a queuing system. Steady state system size distribution in M/M/1 queuing system (only statement). Waiting time distributions. Little’s formula, measures of effectiveness, derivation of expressions for expected queue length, and expected system size(length) and expected waiting times. Description of M/M/C queuing system.

4 hrs

604: PRACTICAL - VIII

List of Assignments

(Demonstration of practicals using TORA software)

1. Formulation of linear programming problem (LPP) - graphical solution.
2. Solution of LPP - simplex algorithm - 1
3. Solution of LPP - simplex algorithm - 2
4. Transportation problems - 1 (IBFS)
5. Transportation problems - 2 (OBFS)
6. Assignment problems
7. Game theory problems.
8. Inventory problems
9. Replacement problems
10. Queuing problems

Text Books

References


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