Bachelor of Science (B.Sc.)

(Biostatistics & Population Sciences - Honours)

Semester System

DEPARTMENT OF EPIDEMIOLOGY AND BIOSTATISTICS
BELAGAVI, KARNATAKA

C O N T E N T S

Mission

"To strengthen research in each and every KAHER constituent units,

And

Sensitize faculty for QUALITY RESEARCH CULTURE of Internationally established standards"

Preamble

Biological sciences have very large variability, and it is difficult to understand completely all the parameters contributing for the event under study. In this situation applied statistics as a science has a great role to play for identifying the variables and their contributions in health and disease. Statistics has been responsible for accelerating progress in all applied sciences by defining the correct methods of planning, collecting, analyzing and interpreting data for establishing cause and effect relationship.

No science can be learned or progress without continuous updates, hence collecting meaningful information, organizing information, and interpretation of the process and its outcome is always the necessity of all applied sciences, so the applied statistics does not need introduction.

Department of Epidemiology and Biostatistics, KAHER

The Department of Epidemiology and Biostatistics, KAHER, Belagavi is aimed to help in meeting the mandatory need of teaching and research of applied statistics in various Graduate, Post Graduate, Post P.G. and Ph.D. Courses offered by KLEs J. N. Medical College, Belagavi, **KLEs V.K. Institute of Dental Science, Belagavi,** KLEs College of Pharmacy, Bangalore, KLEs College of Pharmacy, Belagavi, KLEs College of Pharmacy, Hubli, **KLEs Institute of Physiotherapy, Belagavi, KLEs Institute of Nursing, Belagavi, and KLEs BMK Ayurveda College of Belagavi.**

Department of Epidemiology and Biostatistics has been offering the following courses in Biostatistics from academic year 2014:

- ✓ *Certificate Course in Biostatistics – designed to meet the research need of Research Scholars and faculty.*

- ✓ *P.G. Diploma in Biostatistics – Medical and Allied subject graduates interested to pursue research career, with at list one paper in Statistics at Graduation level or Certificate in Biostatistics from any University,*
- ✓ *M.Sc. in Biostatistics – three years graduate degree with statistics or mathematics.*
- ✓ *M.Sc. in Epidemiology - graduate degree course in Health, Medical and Allied Subject, M.Sc. Biostatistics working in Health/ Medical disciplines are also eligible.*
- ✓ *Ph.D. in Biostatistics – candidates with Post Graduation in Statistics or Mathematics from a recognised University.*

Its faculty with necessary knowledge and skills to deal with statistical analyses in applied research, and to train students in quantitative analysis and risk managerial skills in their field of interest is well equipped. Substantial facilities are available for higher education Ph.D. etc. in their subjects of interest.

B.Sc. in Biostatistics & Population Sciences

The syllabus of the B.Sc. in Biostatistics & Population Sciences, besides compulsory background courses and courses of general interest, includes advance subjects in the field of Biostatistics – and Demography, alongwith Public Health, International Classification of Diseases & Deaths and Statistical Softwares. The B.Sc. in Biostatistics & Population Sciences course will provide trained manpower, for the sectors needing to churn data for decision making.

What will they learn?

Students will gain specialized knowledge and skills required to teach subject matter, and design, monitor and manage Research in Medical and Allied fields.

Careers

Internationally and nationally the demand for trained Biostatisticians and Demographers far exceeds the availability. Furthermore, the course adds value to medical practice, healthcare and research and they will also be eligible for National Services like IAS, IPS and Indian Statistical Services (ISS).

Eligibility

Pre-University Course/12th Standard of any Board with Statistics/ Mathematics with minimum 50 percent marks for General category, and 45 percent for SC, ST and OBC will qualify for admission to B.Sc. (Biostatistics & Population Sciences, Honours).

Total Intake – 21

Selection Procedure

To maintain high academic standards, the selection of students will be by Personal interview from shortlisted candidates.

Evaluation and teaching schedule:

The course will include theory classes followed by practical assignments comprised of six semesters of three years duration. The practical assignments will be evaluated for the Internal Assessment marks. Average marks obtained in practical assignments, and an examination as replica of final examination before final examination in each semester, will be the Internal Assessment marks.

Six Semester students will also be the members of consultancy teams for data preparation, analysis, cleaning, analysis and interpretation of thesis data of Ph.D. and other Research Scholars of the University. As per their research assignments and interest they will qualify for Honours in Biostatistics or Demography.

The merit students will be eligible to compete for their M. Sc. in Biostatistics/Population Sciences.

Attendance

Students are expected to have 80% of total attendance in theory and practical's. However, students will be expected to cover missed theory and practical classes, giving extra time after discussing with the concerned teachers.

Medium of instruction: English

Course Fees: As per University norms

Duration of course - Three years of six Semesters:

Examination pattern

Theory				
Type of questions	**No. of questions**	**Questions to be answered**	**Marks per question**	**Total marks**
Long Essay	**03**	**02**	**20**	**2 x 20=40**
Short answer	**07**	**05**	**08**	**5 x 08=40**
Sub Total: 19 papers of 80 marks each (19 x 80=1520)				1520
Theory's Internal assessment (19 x 20=380)				380
Seminar Paper (Mentorship program)				
Details	**Synopsis**	**Data quality**	**Analysis/ interpretation**	**Defense**	**Total**
Report	**25**	**60**	**65**	**50**	**200**
G. Total					**2100**

One External Examiner and one Internal will form the practical examination team.

Internal Assessment

For internal assessment 35% marks are essential to appear for University theory examinations.

Evaluation

- Minimum 40% overall, 40% marks in theory, Research Project and practical, and 35% in Internal Assessment, together shall qualify to pass the B.Sc. in Biostatistics and Population Sciences.

The mode of evaluation for Seminar Paper will be based on the presentation of the Research documents by the candidate before the Mentor and the Faculty of the Department of Epidemiology and Biostatistics, which will be arranged during 5th & 6th Semesters.

Results

A candidate who scores less than 40% of the total marks in an individual subjects has to reappear for the same subject in subsequent examination conducted by the university. Clearing half of the papers is mandatory for eligibility of admission in subsequent semester.

- Class shall be awarded as under:

  Distinction: 75% and above

  First class   60% and above but less than 75%

  Second class   50% and above but less than 60 %

  Pass class   40% and above but less than 50 %

  (Grading and Marks are subject to KAHER University Rules and Regulations)

Total teaching and practical duration- First, Second and Third years

Teaching for each subject will be (60 hours theory + 40 hours practical and tutorial) =100 hours.

Syllabus For B. Sc. Biostatistics & Population Sciences, Honours

Year I

Semester – 1

1.1 Basic Mathematics (70L+30P) hours
Linear Algebra – Linear Equations and Polynomials alongwith their solutions
Integration – Linear functions, Exponential functions alongwith applications in Statistics
Differentiation – Linear functions, Exponential functions alongwith applications in Statistics
Matrix & Determinants – Definition of Matrix and its components, Addition, Subtraction, Multiplication, Inverse of the Matrix, Solution of Multivariate Regression with applications in Statistics

1.2 Basic Statistics (60L+40P) hours
Statistics Definition – alongwith uses in Health and Disease (Pre-Para and Clinical medical subjects)
Types of Variables and measurements – Quantitative, Qualitative, Semi-Quantitative alongwith measurement scales
Tabulation for different types of the data alongwith definition of classification
Graphical Representation by types of data for univariate and bivariate presentation
Measures of Central Tendency and Location – Mean, Median, Mode and Measures of Location- Quartiles, Quintiles, Deciles and Percentiles
Measures of Dispersion – Range Deviation, Quartile Deviation etc., Mean Deviation, Variance, Standard Deviation, Coefficient of Variation
Measures of Central Tendency and Variation for Qualitative Variables
Karl Pearson's Coefficients, Correlation and Concepts of Regression

1.3 Basic Epidemiology (60L+40P) hours
Health and Disease Concepts,
Approaches in Epidemiology – General Epidemiology and Clinical Epidemiology
Rates, Ratios and Proportion, Prevalence, Incidence, Attributable Risk, Relative Risk, Odds Ratio, Risk Ratio alongwith their Standard Errors and Confidence Intervals (Point and Interval estimation)

1.4 Basic Demography (60L+40P) hours
Censuses in India and World, Age and Sex Composition, Data Appraisal and adjustments, Sex Ratio, Dependency Ratio, Population Theories, Demographic Transition.

Suggested readings

1. Khuri, A. I. (1983): Advanced Calculus with Applications in Statistics, Wiley.
1. Searle, S. R. (1982): Matrix Algebra Useful for Statistics, Wiley
2. Croxton F.E, Cowden D.J and Kelin S (1973): Applied General Statistics, Prentice Hall of India.
1. Mood A.M, Graybill F.A and Boes D.C. (1974): Introduction to the Theory of Statistics, McGraw Hill.

2. Armitage, P., Statistical Methods in Medical Research, London, Blackwell Scientific Publications, 1989.
3. Henry S Shryock, Jacob S Siegel & Associates, The Methods & Material of Demography, U.S. Bureau of the Census, U.S. Government Printing Office, Washington D.C. - Vol I & II, 1980.
4. Park K., Test Book of Preventive and Social Medicine, Edition 21, 2011

Semester – 2

2.1 Sampling Techniques and Design (60L+40P) hours
Concepts of Sampling and Non Sampling Errors, Population and Sample, Simple Random Sampling, Stratified Sampling, Systematic Sampling, Cluster Sampling, Multistage Sampling, Multiphase Sampling, Quota Sampling, Inverse Sampling alongwith Sample Size Estimation for all Sampling Techniques

2.2 Registration Systems and Sample Surveys (60L+40P) hours
Vital Events and Registration, Population and Health surveys – Civil Registration System (CRS), Sample Registration System (SRS), National Sample Survey (NSS), National Family Health Survey (NFHS), District Level Health Surveys (DLHS), Reproductive and Child Health Survey (RCHS) – Nature and limitation of data.

2.3 Probability Theory (60L+40P) hours
Definition and Concepts in Probability- Classical and Relative Frequency Approach to Probability, Cramer and Kolmogorov's approaches to Probability, Merits and Demerits of these approaches, Random Experiments: Trials, Sampling Units and Sampling Space, Mutually Exclusive and Exhaustive Events. Discrete Sample Space, Conditional Probability, Bayes' theorem and its applications. Random Variables,
Chebyshev's inequality and applications, Statements and Applications of Weak Law of Large Numbers and Central Limit Theorems

2.4 Epidemiology of Communicable and Non-communicable Diseases (60L+40P) hours
Statistical Methods in Epidemiology of Communicable and Non-communicable Diseases,
Concepts of Experimental Epidemiological, Measures of Diagnostic Evaluations
Communicable Diseases – Tuberculosis, Cholera and Malaria excluding Treatment, Disease Management and Control.
Non-communicable Diseases – Cardiovascular Diseases, Hypertension, Diabetes, and Cancer excluding Treatment and Management.

Suggested readings

1. Edward P.J., Ford J.S.and Lin (1974): Probability for Statistical Decision-Making, Prentice Hall.
2. Goon A.M., Gupta M.K., Das Gupta.B. (1999): Fundamentals of Statistics, Vol.II, World Press, Calcutta.
3. Armitage, P., Statistical Methods in Medical Research, London, Blackwell Scientific Publications, 1989.
1. Cochran W.G and Cox G.M (1957): Experimental Designs, John Wiley and Sons.
2. Sukhatme B.V(1984) : Sample Survey methods and Its Applications, Indian Society of Agricultural Statistics.
3. Srinivasan K. (2011): Training Manual on Demographic Techniques, M/s. Gita Offset Printers Pvt. Ltd., C-90, Okhla Industrial Area, Phase-I, New Delhi.

Year II

Semester – 3

3.1 Theoretical Distributions (60L+40P) hours
Normal Distribution, Binominal Distribution, Poisson Distribution, Negative Binominal, and Geometric Distribution alongwith their properties and utility in Descriptive and Inferential Statistics.

3.2 Statistical Inference (60L+40P) hours
Concept of a Statistic and Sampling Distribution, Point and Interval Estimate of a Parameter, Standard errors, Null and Alternative Hypotheses, Statistical Tests and Distributions, Concepts of Type I & II Errors, p- values, Chi-square tests, t – test, Z-test and F-test.

3.3 Research Methodology (60L+40P) hours
Concepts and definitions of Research, Thesis Structure/ Critical Review for Consistency Formulation of objectives, Topic-Title link (Critical appraisal of Review of Literature for need and sample size), Research Title-Consistency with Objectives, Standard Operating Procedures (SOP) & Expected Outcome/s and Statistical Analysis, Methods of data collection,
Questionnaire Development, Pre-testing of Questionnaire, Internal & External Validity (Accuracy) of questions, Collection and Scrutiny of Data: Primary Data, Study Designs; Cross Sectional, Case Control & Retrospective, Cohort, Prospective & Longitudinal Studies, Experimental/ Intervention Studies, Randomized Control Trials, Pre Post Designs, Crossover Designs and Case Reports

3.4 Nuptiality and Fertility (60L+40P) hours
Nuptiality in Indian and International Context, Measures of Nuptiality,
Definition of Natural Fertility, Fertility, Fecundity, Fecundability, Measures of Fertility, Measures of Reproduction, Concepts of Cohort and Period fertility, Sources of fertility data

Suggested readings
1. Armitage, P., Statistical Methods in Medical Research, London, Blackwell Scientific Publications, 1989.
2. Henry S Shryock, Jacob S Siegel & Associates, The Methods & Material of Demography, U.S. Bureau of the Census, U.S. Government Printing Office, Washington D.C. - Vol I & II, 1980.
3. Park K., Test Book of Preventive and Social Medicine, Edition 21, 2011
4. Siegel, S., Non-Parametric Statistics for Behavioural Sciences, New York, McGraw-Hill,1988
5. D.J.Finney (1978) : Statistical Methods in Biological Assays, Charles Griffics & Co.
6. Kluwer. Z.Govindarajulu (2000) : Statistical Techniques in Bioassay, 2nd Edition, S.Karger.
7. D.W.Hosmer & S.Lemeshaw (1989) : Applied Logistic Regression Wiley.

8. Goon A.M., Gupta M.K., Das Gupta.B. (1991): Fundamentals of Statistics, Vol.I, World Press, Calcutta.
9. P.S.S. Sunder Rao, J. Richard, Introduction to Biostatistics and Research Methods, Prentice-Hall of India Private Limited, 2006.
10. Armitage, P., Statistical Methods in Medical Research, London, Blackwell Scientific Publications, 1989.
11. Hill, A.B., Principles of Medical Statistics, London, Edward Arnold, 1981.
12. Reid, Norma, G., Research Methods and Statistics in Health Care, London, Adward Anrold, 1987.
13. Pauli, H.G. Training in research methodology: (Advisory Committee on Medical Research, 25th Session, Geneva, 10-13 October 1983). Geneva: World Health Organization, 1983.

Semester – 4
(Seminar Paper Selection – Using secondary data)

4.1 Design of Experiments (60L+40P) hours
Process of Randomization, Analysis of Variance (one/ two way), Analysis of covariance
Randomized Block Design, Latin Square Designs (Cross-over Designs), Factorial Designs

4.2 Health and Mortality (60L+40P) hours
Concepts and definition of Health & Disease, International Classification of Disease and
Mortality, Disease Burden, Disability and Rehabilitation, Prevalence and Incidence Rates, Direct
and Indirect Adjustment of Mortality Rates, Concepts of Disability Adjusted Life Years
(DALY), Measures of Mortality, Life Tables – Abridged and complete and their measures,
Kaplan Meier Survival Method

4.3 Correlation and Multivariate Regression Analysis (60L+40P) hours
Correlation Coefficient, Partial and Multiple Correlation Coefficients, Coefficient of
Determination, Correlation ratio, Methods of Regression Models in Regression - Least Squares,
Maximum Likelihood, Fitting of Linear Regression and related results, Appropriate Polynomials
Models (Curve fittings), Logistic Regression Analysis.

4.4 Urbanization and Migration (60L+40P) hours
Pattern World Urbanization, Pattern of Urbanization in India, Components of Urban Growth;
Mega cities and Urbanization, Pre-colonial, Colonial and post-colonial phases of urbanization,
Modern and post-modern cities and their problems

Definition of Migration, Types of Migration, Demographic diversity, Lee's theory, Zipf's
Gravity Model, Stouffer 's Opportunities and Intervening Opportunities Model, Roger's model
of Migration, Mobility Field theory, Todaro's Model

Suggested Readings
1. Armitage, P., Statistical Methods in Medical Research, London, Blackwell Scientific
    Publications, 1989.
2. Henry S Shryock, Jacob S Siegel & Associates, The Methods & Material of
    Demography, U.S. Bureau of the Census, U.S. Government Printing Office, Washington
    D.C. - Vol I & II, 1980.
3. Park K., Test Book of Preventive and Social Medicine, Edition 21, 2011

Year III

Semester – 5

5.1 Population Projection (60L+40P) hours

Users of Population Projections, Trend Extrapolation, Linear Change Method, Geometric Change Method, Exponential change, Complex Extrapolation Methods, Polynomial Models, Logistic Models, Autoregressive Integrated Moving Average (ARIMA) Time Series Model, Ratio Extrapolation Methods, Cohort- Component Methods

5.2 Non-parametric tests (60L+40P) hours

Definition of Order Statistics and their distributions, Non-parametric tests; Chi square (test, Goodness of Fit, Independence), Fisher's exact test, McNemar test, Sign test for univariate and Bivariate Distributions, Wilcoxon-Mann-Whitney test, Run test, Median test and Spearman's Rank Correlation test. Friedman's two way ANOVA and Concordance, Cochran Q test, Kruskal-Wallis test

5.3 Biostatistics with Statistical Softwares (60L+40P) hours

Working with Softwares Packages for statistics, Statistics with MS-Excel,
Statistics - SPSS, STATA, EPI info using Syntax and Window Bars

5.4 Seminar Paper (100) hours

Data Collection for Seminar Paper, Data Analysis, Interpretation and Paper writing (each student is expected to write one seminar paper under faculty mentor), students will be evaluated in quality and understanding of the process and making the seminar paper

Suggested Readings

1. Armitage, P., Statistical Methods in Medical Research, London, Blackwell Scientific Publications, 1989.
2. Henry S Shryock, Jacob S Siegel & Associates, The Methods & Material of Demography, U.S. Bureau of the Census, U.S. Government Printing Office, Washington D.C. - Vol I & II, 1980.

Semester – 6

6.1 Seminar Papers Preparation & Presentations (200) hours)
Papers Preparation & Presentations: Students will be evaluated in Training in Data Analysis, Interpretation, Defense and Publication (Equivalent to two theory papers)

6.2 International Classification of Disease (ICD), Mortality and Disabilities (200) hours
Training for Research in Clinical and Para-clinical subjects through ICD coding (Equivalent to two theory papers), students will be evaluated in efficiency in ICD coding and understanding of interpretation of disease coding.

Suggested Readings:

1. ICD-10 (Volume 1), WHO, Geneva, Tenth Revision, 1992
2. ICD-10 (Volume 2), WHO, Geneva, Tenth Revision, 1993
3. ICD-10 (Volume 3), WHO, Geneva, Tenth Revision, 1994