

SYLLABUS FOR Ph.D. ENTRANCE

Biostatistics

UNIT I: Scales of measurement: Basic concepts in response scales, types of scales, categorical scales, nominal scales, ordinal scales and interval or ratio scales, visual analogue scales, Likert scale, composite scales, combination scores, Criteria for a satisfactory scale, Appropriate selection of scale for measuring a variable, Appropriate use of different statistical procedures for different kinds of scale, Principles and approaches in questionnaire development. Open ended and closed ended questions, Questionnaire validity and reliability.

UNIT I: Measures of disease frequency and association, prevalence, incidence, crude, specific and adjusted (standardized) rates, relative risk, odds ratio, standardized mortality ratios, attributable risk and interpretation of measures of association. Descriptive epidemiological studies: correlational studies, case reports and case series, cross sectional studies, hypothesis formulation from descriptive studies. Case control studies, Design and conduct of case control studies, analysis and interpretation of results, bias in case control studies.

UNIT III: Cohort studies: Types of cohort studies, design and conduct of cohort studies, analysis and interpretation of results, bias in cohort studies, Retrospective cohort studies, Bias in epidemiological studies, Types of bias, control of bias, evaluation of role of bias and confounding, nature of confounding, methods of controlling confounding. Statistical association and cause effect relationship, Evaluation of the presence of valid statistical association, Epidemiological approach to causation, judgment of a cause- effect relationship.

UNIT IV: Sources of data, Presentation and summarization of data, qualitative or discrete data, Quantitative or continuous data, Types of variables, Dependent and independent variables, Selection of

variables, Clarifying variables, data presentation, tables, Frequency distribution drawings charts and diagrams. Measures of central tendency and location, Mean, median, mode, position average, and percentile. Measures of dispersion, Range, inter-quartile range, mean deviation, standard deviation and coefficient of variation.

UNIT V: Probability: Probability scale, measurement of probability, laws of probability for independent events, conditional probability, Bayes' theorem. Additional law of probability, Multiplication law of probability, Probability distribution, Probability chance from shape of normal distribution or normal curve, binomial distribution, Poisson distribution, normal distribution, Standard normal deviate, Asymmetrical distribution, t distribution.

UNIT VI: Statistical sampling, Population, sample, sampling variations and bias, probability sampling methods, Simple random sampling, Systematic random sampling, Stratified random sampling, Multistage sampling, Multiphase sampling, Cluster sampling, Advantages and disadvantages of different types of sampling, Appropriate use of different types of sampling, Non probability sampling methods, Sample size, Concepts in calculation of sample size.

UNIT VII: Evaluating role of chance, Normal distribution, inferential statistics, hypothesis testing, p value, confidence intervals. Confidence interval for mean, statistical test of significance for difference between two means and more than two means (ANOVA). Confidence interval for proportion, statistical test of significance for difference between two proportions and more than two proportions (chi-squared test).

UNIT VIII: Correlation, Correlation coefficient, Positive correlation, Negative correlation, Rank correlation, Linear regression, Simple and multiple regression and logistic regression. Non parametric methods, Sign test, Wilcoxon signed-rank test, median test, Mann-Whitney test, Kruskal-Wallis test, Friedman test, Spearman rank correlation coefficient. Advantages of non-parametric methods over parametric methods, disadvantages of non-parametric methods over parametric methods, and applications of non- parametric tests.

UNIT IX: Concept of Computer Hardware, Software, and Computer Languages
Techniques in Molecular Biology Artificial Intelligence, Machine learning, deep machine learning, model develop, supervised and unsupervised training of AI model

Reference books:

1. Introduction to Mathematical Statistics, S C Gupta & Kapoor (2006)
2. Introduction to Probability & Statistics by V K Rohatgi (2008)
3. Introduction to linear regression analysis by D C Montgomery (2006)
4. Epidemiology in medicine, Charles H. Hennekens and Jules E. Burling. (1987)
5. Essentials of Medical Statistics by Bely R. Kirkwood. 2nd edition (2003)
6. An Introduction to biostatistics by P.S.S. Sundar Rau. (2006)
7. Research Methodology, methods and techniques by C.R. Kothari. (2018)
8. Basic epidemiology, 2nd edition, R Bonita, R Beaglehole and T Kjellstrom (2007)
Statistical methods in medical research, 4th edition, P Armitage, G Berry and JNS Matthews. (2001)
9. Biostatistics: A foundation for analysis in health sciences, 10th edition, Wayne W Daniel 2012