Syllabus

First Year – Semester I

Paper 1: Basic Mathematics and Statistics	Total (48Lecture + 32Practical)/Week
Basic Mathematics (Lectures) Integration (2), Differentiation (2), Matrices (4), Determinants (1), Difference tables and methods of Interpolation(4), Newton's and Lagrange's methods of Interpolation (2), Divided Differences, Numerical Differentiation and Integration (3), Trapezoidal Rule, Simpson's One-third Formula (2), Iterative Solution of Non-Linear Equations (2). **Basic Statistics** Statistical population and sample from a population **Data Types** Qualitative, Quantitative, Semi-quantitative, Types of scales - nominal, ordinal, ratio, continuous and interval (2). **Collection and Scrutiny of Data** Primary data - Designing a Questionnaire and a Proforma, Checking their consistency (2). Secondary Data - its major sources including some government publications (1). **Presentation of Data** Construction of tables with one or more factors of classification (2). **Diagrammatic and Graphical Representation** Frequency distributions, Cumulative Frequency Distributions and their Graphical Representation, Histogram, Frequency Polygon and Ogives. Stem and Leaf Chart. Box Plot (5). **Analysis of Quantitative Data** Measures of Central Tendency, Location (4), Dispersion and Relative Dispersion, Skewness and Kurtosis (5). **Analysis of Categorical Data** Measures of Central Tendency & Dispersion, Consistency of categorical data, Independence and Association of Attributes. Measures of Association. Odds Ratio and Relative Risk (5).	**Practical: Basic Mathematics:** Integration, Differentiation, Matrices, Determinants (6), Difference tables and methods of Interpolation, Newton's and Lagrange's methods of Interpolation (2), Divided differences, Numerical Differentiation and Integration (2), Trapezoidal Rule, Simpson's one-third Formula (2), Iterative Solution of Non-linear Equations (2). **Basic Statistics** Construction of tables with one and more factors of classification (4). **Diagrammatic and Graphical Representation** Grouped data. Frequency Distributions, Cumulative Frequency Distributions and their Graphical Representation, Histogram, Frequency Polygon and Ogives, Stem and Leaf Chart, Box Plot (8). Dispersion and Relative Dispersion, Skewness and Kurtosis (4). **Analysis of Categorical Data** Measures of Central Tendency & Dispersion, Association for two - three-way classified data. Odds Ratio and Relative Risk (3).

Paper 2: Probability Theory	Total(48Lecture + 32Practical)/Week
Probability theory Important Concepts in Probability(2), Definition of probability - classical and relative frequency approach to probability (2), Cramer and Kolmogorov's approaches to probability, merits and demerits of these approaches (only general ideas to be given) (2). **Random Experiment** Trial, sample point and sample space, definition of an event, operation of events, mutually exclusive and exhaustive events. Discrete sample space, properties of probability based on axiomatic approach, conditional probability, independence of events, Bayes' theorem and its applications. Random Variables(5), Definition of discrete random variables, probability mass function, idea of continuous random variable, probability density function, illustrations of random variables and its properties (5), Expectation of a random variable and its properties - moments, measures of location(4), Dispersion, skewness and kurtosis, probability generating function (if it exists), their properties and uses (8). **Standard univariate discrete distributions and their properties** Discrete Uniform, Binomial, Poisson, Hypergeometric, and Negative Binomial distributions (8). Continuous univariate distributions- uniform, normal, Exponential, Chi-Square, and Gamma distributions. Bivariate normal distribution (including marginal and conditional distributions) (10). Chebyshev's inequality and applications, statements and applications of weak law of large numbers and central limit theorems (2).	**Probability theory** **Random Experiment** Bayes' theorem and its applications. Random Variables (3), Discrete random variables, probability mass function, idea of continuous random variable, probability density function, illustrations of random variables and its properties (5), Expectation of a random variable and its properties -moments, Measures of Location (4), **Random Experiment** Dispersion, skewness and kurtosis, probability generating function (if it exists), their properties and uses (6). Discrete Uniform, Binomial, Poisson, Hypergeometric, and Negative Binomial distributions (6). Continuous univariate distributions- uniform, normal, Exponential, Chi-Square, and Gamma distributions. Bivariate normal distribution (including marginal and conditional distributions) (8).

Paper 3: Sampling Techniques and Designs	Total (48Lecture + 32Practical)/ Week
Sampling techniques Concepts of sampling vs. population (2), Simple random (6), Stratified (6), Cluster (4), Systematic (4), Multistage (4), Inverse (1), Non-probability (quota, purposive) (1), **Designs with Sample Size** Case control studies (4) Retrospective Studies (2) Prospective Studies (1), Case series studies (2) Case reports (1) Cohort Studies (4) Cross Sectional Studies (5) Longitudinal Studies (1)	**Sampling techniques** Simple random sampling (4), Stratified (6), Cluster (4), systematic (2), Multistage (1), Inverse (1), Non-probability (quota, purposive), **Designs with Sample Size** Case control studies (2) Retrospective Studies (2) Prospective Studies (2) Case series studies (1) Case reports (1) Cohort Studies (2) Cross Sectional Studies (3) Longitudinal Studies (1)

Paper 4: Methods in Statistical Inference	Total (48Lecture + 32Practical)/Week
Definition of a Random Sample Simulating random sample from Standard Distributions (4), Concept of derived distributions of a function of random variables (2). Concept of a statistic and its Sampling Distribution (2), Point estimate of a parameter(1), Concept of bias and standard error of an estimate (1). Standard Errors of Sample Mean (1), Sample Proportion (1). **Distributions** Sampling Distribution of sum of Binomial (1), Poisson (1) and mean of Normal distributions (2). Independence of Sample Mean and Variance in Random Sampling from a Normal Distribution (without Derivation) (1). **Statistical Tests** Statistical Tests and Interval Estimation (2), Null and Alternative Hypotheses (1), Types of Errors, p-values (2), Statement of Chi-square (2), t – test (1), and F statistics (2). Testing for the Mean and Variance of univariate Normal Distribution (1), Testing of equality of two Means (2) and testing of equality of two Variances of two univariate Normal Distributions and related Confidence Intervals (2). Testing for the significance of Sample Correlation Coefficient in Sampling from Bivariate Normal Distribution (1), Equality of Means and equality of Variances in Sampling from Bivariate Normal Distributions (2). **Large Sample Tests** Use of Central Limit Theorem for Testing and Interval Estimation of a Single Mean and a Single Proportion and difference of two Means and two Proportions (2), Fisher's Z transformation and its uses (1). Pearson's Chi-square test for Goodness of Fit and for Homogeneity for Standard Distributions (2). Contingency Table and test of Independence in Contingency Table (2). **Meta-Analysis** Systematic Review & Meta-Analysis (7)	**Methods in Statistical Inference** Random sample- Derived distributions of a function of random variables (2). Standard Errors of Sample Mean (1), **Distributions** Sampling Distribution of sum of Binomial (2), Poisson (2) Mean of Normal Distributions (2). Statistical **Statistical Tests** Tests and Interval Estimation (1) Chi-square (2), t - test (1), and F statistics (2). Testing for the mean and variance of univariate Normal Distribution (1), Testing of Equality of two means (1) and Testing of Equality of two variances of two univariate Normal Distributions and related Confidence Intervals (1). Testing for the significance of sample correlation coefficient in sampling from Bivariate Normal Distribution (2), Equality of means, equality of variances in sampling from Bivariate Normal distributions, **Large Sample Tests** Testing and interval estimation of a single mean and a single proportion and difference of two means and two proportions(2), Fisher's Z transformation and its uses (1). Pearson's Chi-square test for goodness of fit and for homogeneity for standard distributions (2). Contingency table and test of independence in a contingency table (1). **Meta-Analysis** Systematic Review & Meta-Analysis (6)

Semester – II

Paper 1: Regression Analysis and Demography	Total (48Lecture + 32Practical)/Week
Regression Analysis Bivariate Data (1), Scatter diagram (2). Product Moment Correlation Coefficient and its properties (5). Coefficient of Determination (1). Correlation ratio (2). Concepts of Error in Regression (1). Principle of Least Squares (2). Fitting of Linear Regression and related results (6). Fitting of curves Reducible to Polynomials by transformation (8). Rank correlation — Spearman's and Kendall's measures (5). **Multivariate data** Multiple Regression (7), Multiple correlation and Partial correlation in three variables, their Measures and related results (8).	**Regression Analysis** Scatter diagram (2). Product Moment Correlation Coefficient and its properties (2). Error in regression (2). Fitting of Linear Regression and related results (5). Fitting of curves reducible to Polynomials by transformation (6). Rank correlation — Spearman's and Kendall's measures (4). **Multivariate data** Multiple Regressions (5), Multiple correlation and partial correlation in three variables, their measures and related results (6).

Paper 2: Multivariate Analysis	Total (48Lecture + 32Practical)/Week
Multivariate analysis Linear (8), Logistic (7), Survival analysis (7), Path analysis (6), Multicollinearity and Homoscedasticity and adjusting for them in Regression models (4), Discriminant Analysis (8), Factor Analysis with its uses, including their utility in Health and Disease (8).	**Multivariate analysis** Linear (5), Logistic (4), Survival analysis (5), Path analysis (5), Multicollinearity and Homoscedasticity and adjusting for them in Regression models (1), Discriminant Analysis (4), Factor Analysis with its uses, including their utility in Health and Disease(4).

Paper 3: Demography-I	Total (48Lecture + 32Practical)/Week
Census and Population Structure Population Censuses World and India (2), Concepts of population evolution (2), Population change (4), Population Structure, including their stability and its measures (6), **Fertility** Concepts and Measures of Fertility(12), **Mortality and Life Table** Concepts and Measures of Mortality (12) & Life Tables (10)	**Census and Population Structure** Population change (4), Population Structure including their Stability and its Measures (4), **Fertility, Mortality & Life Tables** Fertility (8), Mortality (8) Life Tables (8)

Paper 4: Demography-II	Total (48Lecture + 32Practical)/Week
Urbanization & Migration Urbanization (8), Migration (6), **Socio-cultural** Marriage, Education (6), Population theories, Population Policies, including their utility in Health (8), Human Resource Management (6). **Projections** Methods in Population Projections and its utility in Health and Human Resource Management (12), Family Planning (2).	**Urbanization & Migration** Urbanization (6), Migration (6), Marriage (5), Education (5), Population Projections (10)

Second Year

Semester – III

Paper 1: Design of Experiments	Total(48Lecture + 32Practical)/Week
Design of experiments Process of Randomization (2), Randomized Block Designs (8), Latin Square Designs (8), Factorial Designs (8), Analysis of Variance (one/ two way), Analysis of Covariance(8), Incomplete Non-Factorial and Cross-over Designs (8), Analysis of Categorical data (8), including their utility in Health and Experimental studies in Pharmacy, Physiotherapy, Nursing etc.	**Design of experiments** Process of Randomization (2), Randomized Block designs (4), Latin Square Designs (4), Factorial Designs (4), Analysis of Variance (one/ two way), Analysis of Covariance (4), Factorial Designs(4), Incomplete Non-Factorial and Cross-over Designs (4), Analysis of Categorical Data (6).

Paper 2: Non-parametric tests	Total(48Lecture + 32Practical)/Week
Non-parametric tests Definition of Order Statistics and their distributions(10), Non-Parametric tests; Chi square (test, Goodness of Fit, Independence), Fisher's exact test (8), McNemar test, Sign test for univariate and Bivariate Distributions (8), Wilcoxon-Mann-Whitney test (5), Run test, Median test and Spearman's Rank Correlation test (5). Friedman's two way ANOVA and Concordance, Cochran Q test (5), Kruskal-Wallis test (7)	**Non-parametric tests** Order Statistics and their Distributions (4), Non-Parametric tests; Chi-Square (test, Goodness of Fit, Independence), Fisher's Exact Test (2), McNemar test, Sign test for Univariate and Bivariate Distributions (8), Wilcoxon-Mann-Whitney test (6), Run test, Median test and Spearman's Rank Correlation test (2), Kruskal-Wallis test (6) Friedman's two way ANOVA and Concordance, Cochran Q test (4)

Paper 3: Epidemiological and Research Methodology	Total(48Lecture + 32Practical)/Week
Epidemiology Statistical Methods in Epidemiology of Communicable (10) and Non-Communicable Diseases (10). Methods to Valuate test's Efficacy in Hospital and Community Setup (4). **Research methodology** Concepts and definitions (1), Formulation of objectives (1), Study Designs and Basic Analytical Methods for their Analysis (5), Relevant Sampling Techniques (5), Importance of Sampling Size, Feasibility, drawing conclusions (2), Critical appraisal of Published Articles (2L), Methods of Data Collection (2), Questionnaire Development and Pre-Testing of Questionnaire (2), Internal & External Validity (Accuracy) of Questions (2), Study Designs (2).	**Epidemiology** Statistical Methods in Epidemiology of communicable (4) and Non-Communicable Diseases (4). Methods to Valuate test's Efficacy in Hospital and Community Setup (5). **Research methodology** Formulation of Objectives (2), Study Designs and Basic Analytical Methods for their Analysis (4), Relevant Sampling Techniques(5), Importance of Sampling Size, Feasibility, drawing Conclusions (4), Critical Appraisal of Published Articles (4).

Paper 4: Research – Dissertation-I	**(No Written Examination)**
Writing Synopsis, seminars to finalize Synopses, Preparation of questionnaire, pre-testing and finalizing of Questionnaire, Data Collection	

Semester – IV

Paper 1: Statistical Softwares	Total(48Lecture + 32Practical)/Week
Introduction to Computers, Hardware, Softwares (2) **Working with Software Packages** MS-Excel (2), SPSS (4), Tabulation and Frequency Tables (2). Bar Graphs, DOT Diagram and Histogram, Stem-and-Leaf Plots, Box Plots (6). **Summary Statistics** Two-way tables and plots (4). Product Moment Correlation Coefficient, Rank Correlation Coefficient (2). **Curve fitting by method of least squares** Exponential and Polynomial (4). Regression Analysis(4), Correlation ratios, Multiple and Partial Correlation Coefficients (4). Regression equations (6). Rank and Inverse of a Matrix Solution of set of Linear Equations (2). Fitting of Binomial, Poisson, Negative Binomial, Normal and Gamma Distributions (6).	**Working with Software Packages** MS-Excel (2), SPSS Classification (2), Tabulation and Frequency Tables (1). Bar Graphs, DOT Diagram and Histogram, Stem-and-Leaf Plots, Box Plots (4). **Summary Statistics** Two-way tables and plots (1). Product Moment Correlation Coefficient, Rank Correlation Coefficient (1). **Curve fitting by method of least squares** Exponential and Polynomial (3). Regression Analysis(4), Correlation ratios, Multiple and Partial Correlation coefficients (2). Regression equations (4). Rank and Inverse of a matrix Solution of set of linear equations (2). Fitting of Binomial, Poisson, Negative Binomial, Normal and Gamma Distributions (6).

Paper 2: Hospital Data Management & Population Genetics	Total(48Lecture + 32Practical)/Week
Medical Records Management and its Statistical Measures: Indoor and Outdoor Admissions Statistics (4), Bed Occupancy, Average Stay, Bed Turnover Rate (4), Including generating Evidence Based Medicine (EBM), using service data (4). **International Classification of Diseases** Concepts, Certification of Birth and Death, Generation of reports (8), Notifiable Diseases (2) **Population Genetics** Random mating, Genetical Variance and Correlations, Multiple Alleles and Blood types, Maximum Likelihood Method of Estimation, Sex linked Genes, Autopolyploid, Stationary Distributions of Genes Frequency (26).	**Medical Records Management and its Statistical Measures:** Indoor and Outdoor Admissions Statistics (4), Bed Occupancy, Average Stay, Bed Turnover Rate (4), Including generating Evidence Based Medicine (EBM) using service data (2). **International Classification of Diseases** Certification of Birth and Death, Generation of Reports (6), Notifiable Diseases (2) **Population Genetics** Random Mating, Genetical Variance and Correlations, Multiple Alleles and Blood types, Maximum Likelihood Method of Estimation, Sex Linked Genes, Autopolyploid, Stationary Distributions of Genes Frequency (14).

Paper 3rd & 4th: Research – Dissertation-II	**(No written examination)**
Data Cleaning, Analysis, Dissertation Writing, Publication of at least 1 paper.	