



National Institute of Epidemiology

MSc. BIostatistics PROSPECTUS

MSc Biostatistics Course

Eligibility criteria

- Bachelor Degree in Statistics
- Any Bachelor Degree with statistics as ancillary /allied subject

MSc. Biostatistics Course structure

- **Two years** programme with **four semesters** under CBCS regulations
- Odd semester **July to November** (90 working days)
- Even semesters **January to May** (90 working days)
- One month (approx) semester break each in December & June
- The duration for **completion of the course** is four semesters. The maximum allowed period for completion is **eight semesters**
- **75% attendance essential**

Any candidate who has failed to obtain the prescribed 75% attendance for valid reasons, on special permission from Director of NIE can be exempted and under any circumstances the exemption should not be granted for attendance **below 65%**.

Requirements for proceeding to subsequent semesters

- Candidates shall register their names for the First semester examination after the admission in the PG courses.
- Candidates shall be permitted to proceed from the First Semester up to the Final Semester irrespective of their failure in any of the Semester examination subject to the condition that the candidates should register for all the arrear subjects of earlier semesters along with current (subject) Semester subjects.

Choice Based Credit System (CBCS) Regulations

Credit refers to describe the quantum of syllabus in terms of hours of study. It indicates differential weight-age given according to the contents & duration of the courses in the curriculum design.

Core Courses are compulsory subjects offered.

Elective Courses are courses offered by NIE

Supportive courses are of intermediary & introductory level in nature; aimed at bridging the gap in the curricula; Enabling improvement skills in computation & communication.

Human Rights is a compulsory credit course offered in the III semester.

The course is designed under lectures / practical work / Journal review/ Seminars / dissertation work / viva-voce.

Application procedure

Online application - advertised thro NIE & ICMR website

Application submission fee of Rs 1000/-drawn in favour of **Director NIE**

Course fee Rs 60,000 for four semesters (non refundable)

Examination fees as University norms

Method of Selection

- Review/Scrutiny of application form
- Written test/ personal interview

Reservation of seats and concession for SC /ST/ differently abled student as per Govt. norms.

Written test/ personal interview will be held at NIE

Course Subjects

1. No. of Core papers:	13
Practicals:	3
(Including Journal review/seminar)	
2. Elective courses:	2 out of 4
3. Supportive courses:	2 out of 4
4. Dissertation/project work:	1
Total	21

Fee Structure for MSc. Biostatistics Studies

S.No	Particulars	I st year (Rupees)	II nd year (Rupees)
1.	Admission fee	1000	
2.	Registration fee	2000	
3.	Tuition fee	15000	15000
4.	Library fee	1000	1000
5.	Development of infrastructural facilities	2000	2000
6.	Internet/ Bar coded Identity card/Calendar/Magazine	500	500
7.	Laboratory fee	4500	4500
8.	Computer facilities	4000	4000
9.	Dissertation evaluation fee	-	3000
	Total	Rs.30,000	Rs.30,000
	Grand total		Rs. 60000

Accommodation

On-campus limited hostel accommodation is available. Allotment will be based on the first come first served basis.

MSc BIostatistics FRAME WORK

Subject Code Semester -I	Title of the Paper	Weekly Contact Hours	Credits	Internal marks	External Marks	Total Marks
M_BS C01	Basic statistics	5	5	25	75	100
M_BS C02	Statistical inference I - Estimation methods	5	5	25	75	100
M_BS C03	Basic Epidemiology	5	5	25	75	100
M_BS C04	Sampling methods and Sample size determination	5	5	25	75	100
M_BS P01	Statistical Data Analysis using R / SAS / SPSS / STATA- I	6	3	40	60	100
M_BS E01	Elective I	4	4	25	75	100
	Total	30	27	165	435	600
Semester-II						
M_BS C05	Population studies	4	4	25	75	100
M_BS C06	Statistical Inference II – Testing of Hypotheses	4	4	25	75	100
M_BS C07	Longitudinal data analysis	4	4	25	75	100
M_BS C08	Applied Linear Regression Analysis	4	4	25	75	100
M_BS P02	Statistical Data Analysis using R / SAS / SPSS / STATA -II	6	3	40	60	100
M_BS S01	Supportive I	4	4	25	75	100
M_BS E02	Elective II	4	4	25	75	100
	Total	30	27	190	510	700
Semester-III						
M_BS C09	Categorical Data Analysis	4	4	25	75	100
M_BS C10	Time to event data analysis	4	4	25	75	100
M_BS C11	Applied Multivariate Analysis	4	4	25	75	100
M_BS C12	Clinical trials	5	5	25	75	100
M_BS C13	Human Rights	3	3	25	75	100
M_BS S02	Supportive II	4	4	25	75	100
M_BS P03	Statistical Data Analysis using R / SAS / SPSS / STATA - III	6	3	40	60	100
	Total	30	27	190	510	700
Semester-IV						
M_BS PR01	Internship - Dissertation & VIVA VOCE	30	11	50	150	200
	Total	30	811	50	150	200
CUMULATIVE TOTAL		120	92	545	1555	2200
Total weekly contact hours: 120		Total number of credits: 92				

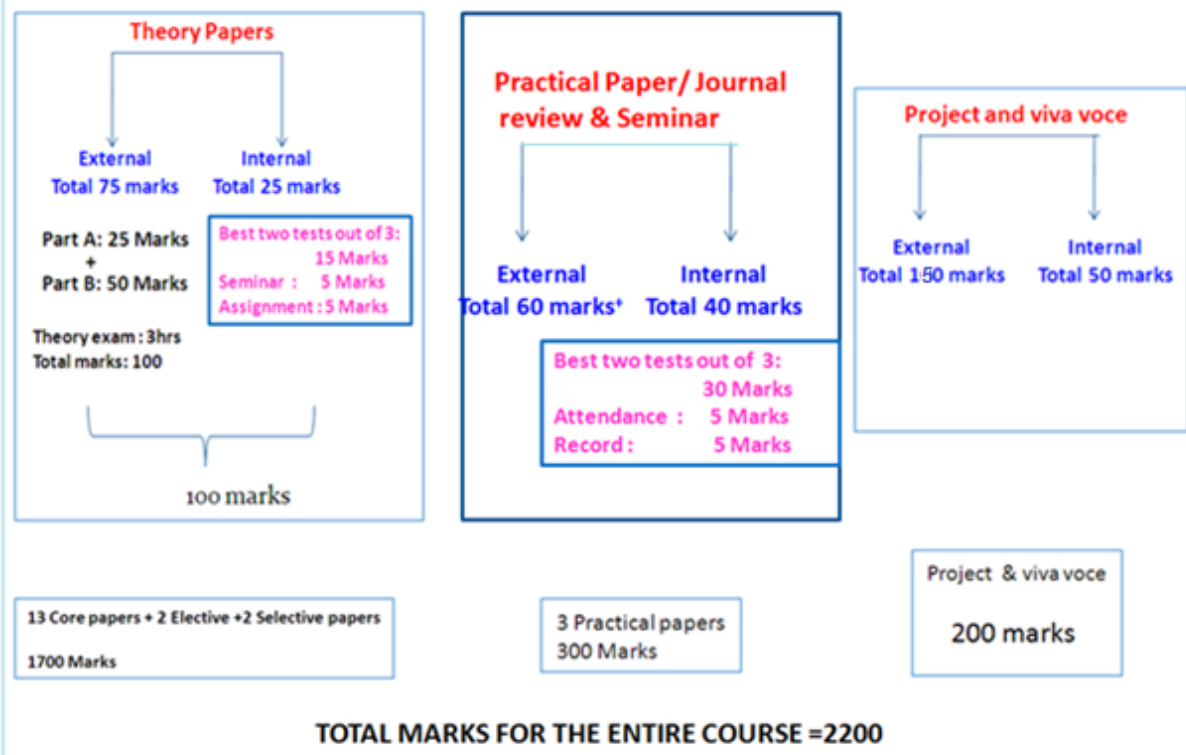
Elective courses

1. Data Management
2. Applied Spatial Statistics
3. Health informatics
4. Bayesian Statistics

Supportive courses

1. Scientific communication
2. Health Economics
3. Field Epidemiology
4. Health Systems

Schematic Diagram of examinations



Grading System

The term Grading system indicates a seven point scale of evaluation of the performance of students in terms of marks, grade points, letter grade and class as given below.

Marks & grades

RANGE OF MARKS	GRADE POINTS	LETTER GRADE	DESCRIPTION
90 – 100	9.0 – 10.0	O	OUTSTANDING
80 – 89	8.0 – 8.9	D+	EXCELLENT
75 – 79	7.5 – 7.9	D	DISTINCTION
70 – 74	7.0 – 7.4	A+	VERY GOOD
60 – 69	6.0 – 6.9	A	GOOD
50 – 59	5.0 – 5.9	B	AVERAGE
00 – 49	0.0	U	RE-APPEAR
ABSENT	0.0	AAA	ABSENT

Course Competencies

- Develop an efficient design for collecting, recording, and storing non spatial & spatial data collected in the conduct of public health and medical research.
- Develop sample size and statistical power calculations for basic study designs including those utilized in clinical trials.
- Produce edited data sets suitable for statistical analyses.
- Perform analyses of stated hypotheses using a variety of analytical tools including analysis of variance, multiple regression, nonparametric statistics, logistic regression, multivariate analyses, spatial data analysis and methods for analyzing rates and failure time data.
- Interpret results of advanced statistical analyses and use these results to make relevant inferences from data.
- Develop written presentations based on intermediate to advanced statistical analyses for both public health professionals and educated lay audiences.
- Develop oral presentations based on intermediate to advanced statistical analyses for both public health professionals and educated lay audiences.

MSc. BIOSTATISTICS CURRICULUM

Basic statistics**Unit 1****Types of Data**

- Qualitative and quantitative data
- cross sectional and time series data
- discrete and continuous data
- Nominal, ordinal, ratio and interval scales

Unit 2**Presentation of Data**

- Frequency distribution and cumulative frequency distribution
- diagrammatic and graphical presentation of data
- construction of bar, pie diagrams, histograms, frequency polygon, frequency curve and ogives

Measures of central tendency

- Mean
- Median
- Mode

Unit 3**Measures of Dispersion**

- Concept of dispersion, characteristics for an ideal measure of dispersion. Absolute and relative measures based on
- Range, inter quartile range, quartile deviation
- coefficient of quartile deviation
- Mean deviation, coefficient of mean deviation
- standard deviation (σ), coefficient of variation
- Properties of these measures.

Moments, Skewness and Kurtosis

- Moments about mean and about any point
- derivation of their relationships
- effect of change of origin and scale on moments
- Coefficients of Skewness and Kurtosis with their interpretations.

Unit 4**Concepts in Probability**

- Random experiment/trial
- sample point, sample space, operation of events
- exhaustive, equally likely and independent events
- Definition of probability-classical, relative frequency
- statistical and axiomatic approach, conditional probability
- Addition & multiplication laws of probability

Unit5

Random Variable and Probability Functions

- Definition of random variable,
- discrete and continuous random variable,
- probability function,
- probability mass function
- probability density functions, distribution function and its properties
- functions of random variables
- Joint, marginal and conditional probability distribution function

Mathematical Expectation and Generating Functions

- Definition and its properties-moments, addition and multiplication theorem of expectation. Conditional expectation and conditional variance.
- Moments generating function, cumulant generating function, probability generating function along with their properties.

BOOKS RECOMMENDED

1. Goon A.M., Gupta M. K., Dasgupta B (2008): Fundamentals of Statistics, Published by Prentice Hall, 2nd edition.
2. Gupta S.C.& Kapoor V.K, (2000): Fundamentals of & Mathematical Statistics, Sultan Chand Sons 10th edition.
3. Croxton F.E., Cowden D.J. & Kelin S, (1967): Applied General Statistics, Prentice Hall.
4. Hogg and Craig, Introduction to Mathematical Statistics, (2013): Prentice Hall, 7th edition.
5. Steel and J H Torrie, Principles and procedures of statistics, (2007): McGraw Hill, 2nd edition.

BOOKS FOR READING (FREE e-BOOKS)

1. <http://www.e-booksdirectory.com/listing.php?category=15>
2. <http://www.analyticsvidhya.com/blog/2016/02/free-read-books-statistics-mathematics-data-science/>

Statistical Inference I – Estimation Methods**Unit 1****Statistical Estimation**

- Parameter and statistic
- Sampling distribution of statistic
- Point and interval estimate of a parameter
- Concept of bias and standard error of an estimate
- Standard errors of sample mean, sample proportion, standard deviation

Unit 2**Properties of a good estimator**

- Unbiasedness
- Efficiency
- Consistency
- Sufficiency
(Definitions & Illustrations)
- Cramer Rao's Inequality (statement-concept)
- Consistency and asymptotic efficiency
- Fisher's Information Function
- Rao-Blackwell theorem (statement-concept)

Unit 3**Methods of Estimation (concepts only)**

- Method of Moments
- Method of maximum likelihood and its properties
- Method of minimum Chi-square

Unit 4**Interval Estimation**

- Confidence interval based on small and large samples (t, f, χ^2 , distributions)
- Sufficiency and unbiased estimation
- Confidence interval for parameters of Normal distribution(s) (with examples)

Unit 5

Bayesian Inference

- Back ground
- Bayes theorem
- Prior and posterior distributions
- Interval estimation
- Fisher's fiducial arguments

BOOKS RECOMMENDED

1. Daniel, W. W (2005): Biostatistics- A foundation for analysis in the Health Sciences, John Wiley & Sons, 7th edition.
2. Hogg, R. V., McKean, J. W. and Craig, A. T. (2006): Introduction to Mathematical Statistics, 6th edition, Pearson Education.
3. Rohatgi, V.K. and Saleh, A.K. (2001): An Introduction to Probability and Statistics, John Wiley & Sons. (Chapter 8, Section 8.1 through 8.8)

BOOKS FOR REFERENCE

1. Casella, G. and Berger, R.L. (2002): Statistical Inference, Thomson Duxbury, 2nd edition.
2. Kale, B.K, (1999): A First Course on Parametric Inference, Narosa Publication, New Delhi, 2nd edition.
3. Pagano, M. and Gauvreau, K. (2000): Principles of Biostatistics, Duxbury, 2nd edition.
4. Rao, C.R. (2002): Linear Statistical Inference and its applications, Wiley series in Probability and Statistics, 2nd edition.

Basic Epidemiology**Unit 1****Introduction to Epidemiology**

- What is epidemiology?
- The historical context Origins
- Definition, scope, and uses of epidemiology

Unit 2**Measures of disease and death frequency**

- Defining health and disease
- Definitions
- Diagnostic criteria
- Measuring disease frequency
- Population at risk
- Incidence and prevalence
- Case fatality
- Interrelationships of the different measures

Unit 3**Mortality and morbidity**

- Death rates
- Infant mortality
- Child mortality rate
- Maternal mortality rate
- Adult mortality rate
- Life expectancy
- Age-standardized rates
- Morbidity
- Disability measures

Unit 4**Types of epidemiological studies**

1. Observational studies
2. Experimental studies
3. Descriptive studies

4. Ecological studies
5. Cross-sectional studies
6. Case-control studies
7. Cohort studies

Unit 5 Potential errors in epidemiological studies

- Random error
- Systematic error
- Selection bias
- Measurement bias
- The control of confounding
- Validity

BOOKS RECOMMENDED:

1. R Bonita, R Beaglehole. T Kjellström, (2006): Basic Epidemiology 2nd Edition.
http://apps.who.int/iris/bitstream/10665/43541/1/9241547073_eng.pdf
2. Dicker, Richard, (2006): Principles of Epidemiology in Public Health Practice, 3rd edition. <http://www.cdc.gov/ophss/csels/dsepd/ss1978/ss1978.pdf>
3. Altman D G, (2006): Practical Statistics for Medical Research, London: Chapman and Hall, 2nd edition.
4. Leon Gordis M, (2004): Epidemiology, NA Saunders Company, 3rd edition.

BOOKS FOR READING

1. RC Brownson and DB Petittis (1998): Applied Epidemiology: Theory to Practice. Oxford University Press, 2nd edition.
2. SM Teutsch and RE Churchill (1994): Principles and Practice of Public Health Surveillance. Oxford University Press, 2nd edition.
3. CDC's Morbidity and Mortality Weekly Reports (MMWR) .
<Http://www2.cdc.gov/mmwr>

Sampling methods and Sample size determination**Unit 1****Introduction**

- Advantages of sampling method
- Some uses of sample surveys
- The principal steps in a sample survey
- The role of sampling theory
- Probability sampling
- Alternatives to Probability sampling, Use of normal distribution, Bias and its effects, The mean square error

Unit 2**Simple random sampling**

- Simple random sampling, Selection of simple random sample, definitions and notation, properties of the estimate, variance of the estimates
- The finite population correction, Estimation of the standard error from a sample, confidence limits
- Random sampling with replacement
- Estimation of a ratio, Estimates of means over subpopulations, Estimates of totals over subpopulations
- Comparisons between domain means, Validity of the normal approximation, Linear estimators of the population mean

Unit 3**Sample size estimation**

- A hypothetical example, Analysis of the problem, The specification of precision
- The formula for n in Sampling for proportions, Rare items-Inverse sampling, The formula for n with continuous data
- Advance estimates of population variances, Sample size with more than one item
- Sample size when estimates are wanted for subdivisions of the population
- Sample size in decision problems
- The design effect

Unit 4 Stratified random and Systematic sampling

- Description, Notation, Optimum allocation
- Estimation of sample size with continuous data, proportions
- Relative precision of stratified and simple random sampling
- Systematic sampling relative to cluster sampling
- Comparison of Systematic with stratified random sampling
- Stratified systematic sampling

Unit 5 Single stage cluster sampling: Clusters of equal and unequal sizes

- Reasons for cluster sampling, A simple rule
- Cluster sampling for proportions
- Cluster Units of unequal size
- Sampling with probability proportional to size
- Selection with unequal probabilities with replacement
- Probability proportional to its size measure

BOOKS RECOMMENDED

1. William G. Cochran, (1997): Sampling Techniques, , John Wiley & sons 3rd edition.
2. Murthy M N (2012): Sampling Theory and methods, Statistical publishing Society, Calcutta 2nd edition.
3. Levy PS, Lemeshow S (1999): *Sampling* of Populations: Methods and Applications, New York: Wiley Interscience, 3rd edition.
4. Lohr SL (2009): Sampling: Design and Analysis. Duxbury Press, 2nd edition.
5. Wayne Fuller (2009): Sampling Statistics, Wiley, 1st edition.

BOOKS FOR REFERENCE

1. Foundations of Inference in Survey Sampling (1997), Cassel, C.M., Sarndal, C.E. and Wretman, John Wiley & Sons, 2nd edition.
2. Floyd J. Fowler (1995), Improving Survey Questions: Design and Evaluation, Sage Publications, 2nd edition.

Population Studies**Unit 1 Introduction to Demography**

- Definition and uses of demographic data
- Source of vital statistics: census method - Registration method
- Sources of Demography Data: Secondary sources - SRS– Surveys

Unit 2 Mortality and Fertility**Mortality Measures**

- Nature And Uses Of Mortality Statistics
- Mortality measures: Merits and demerits of Crude Death Rate (CDR) and Age-Specific Death Rates, Infant Mortality Rate(IMR)

Fertility measures

- Basic terms and concepts used in the study of fertility
- Measures of fertility: Crude Birth Rate, Age specific fertility rate, General fertility rate, Total fertility rate, Gross reproductive rate and Net reproductive rate, Order-specific fertility rates.
- Life table and Abridged life table concepts

Unit 3 Standardization

- Need and importance of standardization
- Direct and indirect technique of standardization of rates and ratios in the light of mortality/fertility rates
- Decomposition of Infant mortality rate and its sub-divisions
- Maternal Mortality Rate and Ratios

Unit 4 Population distribution and indices of dissimilarity

- Population classification - Urban-Rural international Standard definitions
- Rank size Rule for growth pattern
- Index of dissimilarity , Theil's index, Isolation index ,Clustering
- Gini Concentration Ratio and Lorenz Curve

Unit 5 Mobility and Migration

- Concept of mobility and Migration

- Types of migration, internal migration patterns and characteristics in developing countries with a special focus on India.

BOOKS RECOMMENDED

1. Goon A.M., Gupta M. K., Dasgupta B (2008): Fundamentals of Statistics, Published by Prentice Hall, 2nd edition.
2. Gupta S.C.& Kapoor V.K, (2000): Fundamentals of & Mathematical Statistics, Sultan Chand Sons 10th edition.
3. Pathak, K.B. and F.Ram, (1998): Techniques of Demographic Analysis, Mumbai, Himalaya Publishing House, Chapter 4
4. Jacob S. Siegel, David A. Swanson (2004): The methods and Materials of Demography, Elsevier Inc.

BOOKS FOR REFERENCE:

1. Hinde, Andrew (1998), Demographic Methods, London: Edward Arnold, 1st edition.
2. Cox, P. (1959): Demography, Cambridge University Press, 2nd edition.
3. Keyfitz, (1985): Applied mathematical Demography, Springer-Verlag, New York, 2nd edition.
4. Shrivastava, O.S. (1995): Demography and population Studies, Vikas Publishing house private limited, 2nd edition.

Statistical Inference II – Tests of Hypotheses**Unit 1****Introduction to Hypothesis Testing**

- Null and alternative hypotheses- Simple and composite hypotheses,
- Critical region,
- Level of significance, one tailed and two tailed testing,
- Types of errors (I & II)
- Power and Sample size
- P- value interpretation and its associated misconceptions

Unit 2**Test of Hypotheses**

- Neyman-Pearson Lemma,
- Tests based on Binomial, Poisson and Normal distribution(s)

Unit 3**Small and Large Sample Tests****Small Sample Tests**

- Test for means and variances based on t, F, χ^2 distributions.

Large Sample Tests:

Tests and Interval Estimation for

- Single mean, single proportion
- Two means, two proportions
- Fisher's Z transformation

Unit 4**Nonparametric Tests**

- Test of goodness of fit
- Chi square test
- Kolmogrov- Smirnov one sample test
- Sign test,
- Paired sample test
- Wilcoxon signed rank test
- Paired sample rank test

Unit 5**Two sample problems**

- Kolmogrov- Smirnov two sample test
- Mann- Whitney U test
- Wald-Wolfowitz runs test

Sequential Tests

- Sequential methods of drawing inferences
- Sequential probability ratio test (SPRT) – definition and basic concepts
- SPRT for testing simple hypotheses
- Operating Characteristic function
- Average Sample Number function
- Applications to binomial, Poisson and normal distributions

BOOKS RECOMMENDED

1. Conover, W. J. (2006): Practical Non-parametric Methods in Statistics, 2nd edition, (Unit 5).
2. Daniel, W.W. (2006): Biostatistics: A foundation for analysis in the Health Sciences, John Wiley & Sons, 7th edition (Unit 5).
3. Rohatgi,V.K. (1984): An Introduction to Probability Theory and Mathematical Statistics, Wiley Eastern, 3rd edition (Chapter 14-14.5 for SPRT).
4. Rohatgi, V.K. and Saleh, A.K. (2001): An Introduction to Probability and Statistics, John Wiley & Sons, 3rd edition (Chapters 8 - 8.3, 9, 10- 10.1,10.2,10.6, 11 - 11.3).

BOOKS FOR REFERENCE:

1. S.C. Gupta and V.K. Kapoor (2008): Fundamentals of Applied Statistics, Sultan Chand and Sons, 2008 4thedition.
2. G. Casella and R.L. Berger (2002): Statistical Inference, Thomson Duxbury, 2nd edition.
3. E.J. Dudewicz and S.N. Mishra (1988): Modern Mathematical Statistics, John Wiley and Sons, 2nd edition.
4. A.M. Goon, M.K. Gupta and B. Dasgupta (2003): An Outline of Statistical Theory (Vol. I), World Press, Kolkata, 4th edition.

Longitudinal Data Analysis**Unit 1****One way classification**

- Analysis of variance(ANOVA) : One Way, Two Way & generalization
- Single factor ANOVA
- Two-factor ANOVA with unequal and equal replication (with/without interactions)- fixed and random effects models
- Multiple comparison tests-Tukey, Newman-Keul, Scheffe tests

Unit 2**Designs of Experiments**

- Completely Randomized Designs (CRD)
- Randomized Block Designs (RBD)
- Latin Square Designs (LSD)

Unit 3**Advanced Designs for Analysis**

- Repeated measures designs
 - ANCOVA (for CRD and RBD)
 - Factorial Designs ($2^2, 3^2$)

Unit 4**Bioassay**

- Introduction - Direct assays: the nature of direct assays, precision of estimates and the design of direct assays.
- Dose Response Relations: Indirect assays, the dose response regression
- Standard curve estimation, slope estimation, and simultaneous trial estimation

Unit 5**Response Surface Methodology (RSM)**

- Concept of Response Surface Methodology
- Central Composite Designs (CCD)
- Box-Behnken Designs
- Missing Data

(Note: Emphasis on Definitions, Concepts, Applications and Interpretations)

BOOKS RECOMMENDED

1. Das, M.N. and Giri N.C. (2006): Design and Analysis of Experiments Delhi. New Age International (P) Ltd., New, 2nd edition.
2. Montgomery D.C (2006): Design and Analysis of Experiments, Wiley India 5th Edition.
3. Zar, J.H. (2007): Biostatistical Analysis, Pearson Education 4th edition.
4. Govindarajulu, Z. (2000): Statistical techniques in Bioassay, Thomson Duxbury, 2nd edition.

BOOKS FOR REFERENCE

1. Morrison, 91990): Multivariate Statistical Methods, McGraw-Hill, 3rd edition.
2. Johnson, R.A. and Wichern, D.W. Applied Multivariate Statistical Analysis, Pearson Education, Asia 5th edition.
3. Agresti, A. (2002): Categorical data analysis, John Wiley & Sons, 3rd edition.

Applied Linear Regression Analysis**Unit 1****Simple linear regression**

- Assumptions and Estimation of model parameters
- Standard error of estimators
- Testing of hypotheses on slope and intercept (β 's)
- Coefficient of determination (R^2)

Unit 2**Multiple linear regressions**

- Least square estimation of model parameters
- Variance covariance of least squares estimators
- Estimation of error variance
- Tests of hypotheses of regression parameters
- Significance of regression (ANOVA, R^2 and adjusted R^2),
- Dummy variable regression- general concepts and uses

Unit 3**General linear Models (GLM)**

- Introduction - Gauss Markov Setup
- Assumptions - Homoscedasticity & Heteroscedasticity
- Multicollinearity and its solutions
- Autocorrelation - Durbin – Watson test
- Variance stabilizing transformations to linearize the model
- Analytical methods for selecting a transform

Unit 4**Variable Selection**

- Selection of Variables – forward selection, backward elimination and stepwise regression (algorithms only)
- Weighted least squares
- Information Criteria
- Akaike Information Criteria

Unit 5**Introduction to Non-linear Regression**

- Nonlinear regression – transformation to a linear model,
- Usefulness of the nonlinear regression method

- Limitations of the nonlinear regression method
- Use of re-sampling procedures in regression

BOOKS RECOMMENDED

1. Montgomery, D. C., Peck, E. A. and Vining, G. G. (2003): Introduction to Linear regression analysis, John Wiley and Sons, Inc. 3rd edition Chapters 2, 3, 4, 5, 6, 8 (8.1,8.2), 9, 10, 12 (12.1,12.3,12.4), 14 (14.1.2).
2. Zar, J.H. (2006): Biostatistical Analysis, Pearson education, 4th edition Chapter 18 (18.1, 18.2,18.4,18.5).

BOOKS FOR REFERENCE

1. Draper, N.R. and Smith, H. (2003): Applied Regression Analysis, John Wiley and Sons, Inc. 3rd edition.
2. Johnston, J. (1984): Econometric methods, McGraw Hill International, 3rd edition.

Categorical Data Analysis**Unit 1****Contingency table analysis**

- Introduction - Nature of Categorical data - Statistical inference for a proportion
- Contingency Tables and their distribution: Binomial and Multinomial sampling
- Table structure comparing proportions - Comparing proportions in two-by-two tables: Difference of proportions
- Relative risk - Odds Ratio - Properties of Odds Ratio - relationship between Odds Ratio and Relative Risk

Unit 2**Measures of Association**

- Nominal and Ordinal Measures of Association - Inference for Contingency tables: Interval estimation for difference of proportions, odds ratio, log odds ratio and relative risk
- Testing Independence in Two-Way tables: Pearson and Likelihood-ratio chi-square tests - Yate's correction for continuity-Residuals for cells in a contingency table-Partitioning chi-squared
- Trend tests for 2 x J tables - Testing Independence for Ordinal Data-Fisher Exact Test for 2 x 2 tables - Exact Inference for small samples - Association in Three-Way Tables: Partial Tables - Marginal and conditional and Odds Ratios - Homogeneous Association - Cochran-Mantel-Haenszel methods

Unit 3**Logistic regression**

- Logit models for Binary data-Binomial GLM for 2 x 2 contingency tables
- Logistic regression: Interpreting logistic regression - Inference for logistic regression
- Maximum likelihood estimate - test of overall regression and goodness of fit
- Deviance statistic, Wald test, LR test, Score test-Logistic regression diagnostics
- Multiple Logistic Regression

Unit 4**Logit models for multinomial responses**

- Nominal Responses: Baseline-Category Logit Model
- Ordinal Responses: Cumulative Logit Models
- Ordinal Responses: Cumulative Link Models
- Alternative Models for Ordinal Responses

Unit 5 Loglinear models for contingency tables

- Loglinear Models for Two-Way Tables
- Loglinear Models for Independence and Interaction in Three-Way Tables
- Inference for Loglinear Models
- Loglinear Models for Higher Dimensions

BOOKS RECOMMENDED

1. Agresti, A. (2002): Categorical data analysis, John Wiley & Sons, 3rd edition.
2. McCullagh, P. and Nelder, J.A. (1991): Generalized Linear Models, Chapman and hall, London, 2nd edition.
3. Draper NR and Smith H (1981): Applied Regression Analysis, John Wiley & Sons, 3rd edition.
4. Hosmer D., Lemeshow S., Sturdivant RX. Applied Logistic Regression, ISBN-13: 978-0470582473 ISBN-10: 0470582472, 3rd edition.

BOOKS FOR REFERENCE

1. Agresti, A. (1991): An Introduction to Categorical data analysis, John Wiley & Sons, 2nd edition.
2. Armitage, P. and Berry, G. (1987): Statistical methods in Medical Research, Blackwell Scientific Publications, USA, 3rd edition.
3. Deshpande, J.V., Gore, A.P. and Shanubhogue, A. (1995): Statistical Analysis of Non Normal Data, New Age International Publishers Ltd., New Delhi, 1st edition.
4. Hardin, J.W., and Hilbe, J.M. (1994): Generalized Estimating Equation, Chapman and Hall, London, 2nd edition.
5. Hosmer, D.W. and Lemeshow, S.(1989): Applied Logistic Regression, John Wiley & Sons Inc, 2nd edition.

Time to event data analysis**Unit 1****Introduction and definition of time series analysis**

- Components of time series, Trend, seasonal variations, cyclic variations, irregular component
- Method of curve fitting by principle of least squares
- moving average method
- Analysis of seasonal fluctuations
- Construction of seasonal indices using method of simple averages
- ratio to trend method
- ratio to moving average method.

Unit 2**Introduction and terminology used in Survival analysis**

- Survival functions- Concept of Time and event
- Censoring mechanism and truncations
- Order and Random Censoring
- Survival, hazard and density functions
- Mean and median residual life and their elementary properties

Unit 3**The shapes of hazard and survival functions**

- Exponential
- Gamma
- Weibull
- Lognormal
- Preparing survival time data for analysis and estimation

Unit 4**Kaplan Meier methods**

- Point estimation, Confidence Intervals, Scores, tests based on maximum likelihood estimation
- Likelihood ratio, Partial likelihood estimation-log logistic distribution
- Kaplan Meier methods-Estimation of the hazard and survivor functions
- Kaplan-Meier life table and product-limit methods

Unit 5 Nonparametric methods

- Log rank test
- Gehan Test
- Mantel - Haentzel Test
- Tarone - Ware tests
- Efron Tests

BOOKS RECOMMENDED

1. Klein, J.P. and Moeschberger, M.L. (2003): Survival Analysis- Techniques for Censored and Truncated data. Springer Inc, 1st edition.
2. Miller, R.G. (1981): Survival Analysis, John Wiley and Sons, 1st edition.
3. Deshpande, J.V., Gore, A.P. and Shanubhogue, A. (1995): Statistical Analysis of Non Normal Data, New Age International Publishers Ltd., New Delhi, 1st edition.

BOOKS FOR REFERENCE

1. Barlow, R. E. and Proschan, F. (1975): Statistical Theory of Reliability and Life testing, Holt, Rinehart and Winston, New York, 2nd edition.
2. Johnson, E.R.E. and Johnson, N.L. (1980): Survival models and Data Analysis, John Wiley and Sons, 3rd edition.
3. Lee, C.T. (1997): Applied survival analysis, John Wiley, 2nd edition.
4. Croxton F.E., Cowden D.J. & Kellin S (1973): Applied General Statistics, Prentice Hall, 1st edition.
5. Johnson RA and Wichern DW (1984): Applied Multivariate Statistical Analysis, John Wiley & sons, 2nd edition.

Applied Multivariate Analysis**Unit 1****Multivariate Normal Distribution**

- Definition, mean vector, variance-covariance matrix, properties
- Maximum likelihood estimators for mean vector, variance- covariance matrix
- Tests of hypotheses concerning mean vector, variance- covariance matrix (one sample and two sample problems)

Unit 2**Principal component analysis**

- Extraction of components - characteristics and properties of components
- Total variation, relative importance, standardization
- Covariance structures - interpretation of principal components
- Introduction to factor analysis
- Orthogonal factor model
- Estimation by maximum likelihood
- Principal component methods
- Factor scores - factor rotation

Unit 3**Canonical correlation analysis**

- Extraction of canonical correlations and their variables
- Testing the significance of canonical correlations
- Interpretation of canonical variables

Unit 4**Classification and discrimination**

- Classification problem
- Standards of good classification
- Procedures of classification into one of two populations with known probability distributions
- Evaluation of classification function
- Fisher's linear discriminant function.

Unit 5**Cluster analysis**

- Distance and similarity measures
- Agglomerative methods

- Single linkage
- average linkage
- complete linkage methods

Hierarchical clustering methods

- Introduction to Hierarchical clustering methods
- Non-hierarchical clustering methods
- Advantage and disadvantage of Hierarchical clustering methods
- K means method.

BOOKS RECOMMENDED

1. Johnson, R.A. and Wichern, D.W. (2007): Applied Multivariate Statistical Analysis, Pearson Education, Asia, 6th edition.
2. Morrison (1990): Multivariate Statistical Methods, McGraw-Hill,.
3. Allen Agresti (1990) Categorical data analysis, 2nd edition.

BOOKS FOR REFERENCE

1. Anderson, T. W. (2003): An Introduction to Multivariate Statistical Analysis, , John Wiley & Sons, 3rd edition
2. Hair, J.F., Anderson, R.E., Tatham. R.L. and Black, W.C. (2006): Multivariate Data Analysis, Pearson Education, Asia, 5th edition.

Clinical Trials**Unit 1****Introduction to Clinical Trials**

- Historical background – The need and ethics of clinical trials
- Organization and Planning ,Main features of the study protocol
- Selection of patients ,Treatment schedule ,Evaluation of patient response
- Follow-up studies
- GCP/ICH guidelines

Unit 2**Different Phases of clinical trials**

- Phase I, II, III and IV trials
- Basic study designs: Randomized control study, Nonrandomized concurrent control study
- Historical controls, cross-over design, withdrawal studies
- Group allocation design, hybrid designs
- Studies of equivalency

Unit 3**Methods of Randomization**

- Fixed allocation randomization ,Stratified randomization,Adaptive randomization ,Unequal Randomization
- Blinding and Placebos: Unblinded, Single blind and Double-blind trials,conduct of double blind trials
- Crossover trials- Design, Analysis and interpretation

Unit 4**Statistical methods for determining Trial size**

- Method for dichotomous response variable
- Continuous response variables
- Repeated measures
- Cluster randomization and equivalency of intervention
- Multicenter trials

Unit 5**Data management**

- Interim analysis
- Case report form design

- Database design
- Data collection system for good clinical practice
- Terminologies used in Clinical research

BOOKS RECOMMENDED

1. Fundamentals of clinical trials (2010): Lawrence M. Friedman, Curt D. Furberg, David L. DeMets. Springer; 4th edition.
2. Clinical Trials (2006): A practical guide to design, analysis and reporting. Wang D, Bakhai A. Remedica; 1st edition.
3. SPIRIT 2013: New guidance for content of clinical trial protocols. Chan AW, TetzlaffJM, Altman DG, Dickersin K, Moher D. Lancet. 2013 Jan 12;381(9861):91-2.
4. Pocock, S.J. (1991): Clinical Trials – A Practical Approach, John Wiley and Sons.
http://onlinelibrary.wiley.com/doi/10.1002/0470842563.fmatter_indsub/pdf

BOOKS FOR REFERENCE

1. Fleiss, J.L. (1986): The design and analysis of clinical experiments John Wiley & Sons.
2. Meinert, C.L. (1986): Clinical trials: Design, Conduct and Analysis, Oxford university press.
http://samples.sainsburysebooks.co.uk/9781118031179_sample_388791.pdf
3. Piantadosi, S. (2005): Clinical Trials - A Methodological Perspective Wiley series in probability and Statistics, 2nd edition.

Human rights**Unit 1****Background**

- Introduction
- Meaning
- Nature and Scope
- Development of Human Rights
- Theories of Rights
- Types of Rights.

Unit 2**Human rights at various level**

- Human Rights at Global Level UNO
- Human Rights – UDHR 1948 – UN Conventions on Human Rights:
- International Covenant on civil and Political Rights 1966
- International Convent on Economic,
- Social and Cultural Rights
- Racial Discrimination -1966 International.
- Instruments: U.N. Commission for Human Rights
- European Convention on Human Rights.

Unit 3**Human rights in India**

- Development of Human Rights in India
- Human Rights and the Constitution of India
- Protection of Human Rights Act 1993-
- National Human Rights Commission
- State Human Rights Commission
- Composition Powers and Functions
- National Commission for Minorities, SC/ST and Woman

Unit 4**Human Rights Violations**

- Human Rights Violations against Women,
- Human Rights Violations against Children,

- Human Rights Violations against Minorities, SC/ST and Transgenders
- Preventive Measures.

Unit 5

Political issues

- Political, Economic and Health Issues
- Poverty, Unemployment
- Corruption and Human Rights
- Terrorism and Human Rights
- Environment and Human Rights
- Health and Human Rights

BOOKS RECOMMENDED

1. Jagannath Mohanty, Teaching of Human sRights New Trends and Innovations, Deep & Deep Publications, Pvt. Ltd., New Delhi,2009
2. Ram Ahuja: Violence Against Women, Rawat Publications Jewahar Nager, Jaipur.1998.
3. Sivagami Parmasivam, Human Rights, Salem, 2008
4. Hingorani R.C.: Human Rights in India: Oxford and IBA, New Delhi.

Data Management**Unit 1****Basics of computers**

- Introduction,
- CPU
- I/O devices
- memory, storage
- working with files & folders
- system software
- application software
- virus/worms threat management.

Unit 2**Concept of data management**

- Basic terminologies
- working with data base
- coding, data validation
- Data Quality
- Data cleaning
- Data dictionary
- Documentation
- Backups
- Introduction to RDBMS & SQL

Unit 3**Data Management & Analysis**

- Designing Data Capture Interface with Entry/Edit/Delete Options
- data Matching/Compare
- File Handling
- Statistical Procedures
- Programming
- EpiInfo.

Unit 4**Large scale data management**

- Data processing architectures,
- Parallel processing
- Distributed processing
- Online analytical processing
- Multi-query processing

Unit 5**Data Sharing and Re-Use Policies**

- Why data-sharing policies matter?
- Overview of Scientific Data Sharing
- Legal and ethical matter consideration of Research data
- Plan for Archiving and Preservation of Data

BOOKS RECOMMENDED

1. Fred R McFadden, Jeffery A Hoffer, Mary B. Prescott, (2000): Modern Database Management, Addison Wesley, 5th edition.
2. Andrew Vazsonyi, Richard 91980): Introduction to data processing, ISBN 10: 0256023433 ISBN 13: 9780256023435 3rd edition.
3. Garcia-Molina, J. D. Ullman, J. Widom, Database Systems(2008): The Complete Book Prentice Hall, 2nd edition.
4. T. Özsu, P. Valduriez, Principles of Distributed Database Systems (2011): Springer, 3rd edition.
5. T. White, Hadoop (2012): The Definitive Guide, O'Reilly, 3rd edition.
6. J. Lin, C. Dyer (2010): Data-Intensive Text Processing with MapReduce, Morgan and Claypool, 1st edition.
7. E. Redmond, J. R. Wilson (2012): Seven Databases in Seven Weeks: A Guide to Modern Databases and the NoSQL Movement, Pragmatic Bookshelf, 1st edition.

Web pages for reading

1. Why data-sharing policies matter <http://www.pnas.org/content/106/40/16894.full>
2. Alan E. Guttmachera, Elizabeth G. Nabel and Francis S. Collin Data Sharing and Consent March 2010 By Ciara Curtin <http://www.genomeweb.com/data-sharing-and-consent>
3. Guidelines for Responsible Data Management in Scientific Research <http://ori.hhs.gov/education/products/clinicaltools/data.pdf> pgs. 6-8
4. "Who Owns Research Data?" http://ori.dhhs.gov/education/products/columbia_wbt/rcr_data/case/index.html#2
5. "Constructing Access Permissions", University of Oregon Libraries: <http://libweb.uoregon.edu/datamanagement/sharingdata.html#three>

Applied Spatial Statistics**Unit 1****Introduction to Spatial Statistics**

- Components of spatial data
- Geographical coordinates
- Map Projections
- Coordinate Systems
- Types of spatial data: Vector data and raster data
- Remotely sensed data
- Digitizing

Unit 2**Geographic Information Systems (GIS)**

- What is GIS?
- GIS capabilities.
- Basic GIS Operations
- Visualization
- Types of Maps
- Exploratory spatial data analysis

Unit 3**Spatial clustering of health events**

- Global indexes of spatial autocorrelation
- Moran's I
- Geary's C
- Spatial scan statistics

Unit 4**Geostatistics**

- Fitting semivariogram models
- Variogram function,
- Interpolation techniques,
- Kriging
- Inverse distance weighting method

Unit 5**Models**

- Introduction to spatial models
- Spatially correlated data
- Linear regression models for Spatially Autocorrelated data
- Interpretation and use with spatial data
- GeoDa software over view

BOOKS RECOMMENDED

1. Lance A. Waller and Carol A. Gotway (2004): Applied Spatial Statistics for Public Health Data, John Wiley & Sons, 1st edition.
http://samples.sainsburysebooks.co.uk/9780471662679_sample_381451.pdf
2. Bailey, T.C. and A.C. Gatrell (1995): Interactive Spatial Data Analysis. Essex, England, Prentice Hall 1st edition.
3. A. E. Gelfand, P. J. Diggle, M. Fuentes and P. Guttorp (2011) "Handbook of Spatial Statistics edited by Gelfand, A. E., Diggle, P. J., Fuentes, M. and Guttorp, P.
4. N. Cressie (2015): Statistics for spatial data Wiley-Interscience; 2nd edition.
5. S. Banerjee, B. P. Carlin and A. E. Gelfand (2014): "Hierarchical modeling and analysis for spatial data", Chapman & Hall/CRC 6th edition.

BOOKS FOR READING

1. Wiley. Cressie, N. and Wikle, C. (2011): Statistics for Spatio-Temporal Data. Wiley 1st edition.
2. Diggle, P. J. (2003) Statistical Analysis of Spatial Point Patterns 2nd edition.
3. Hodder Arnold. Diggle, P. J. and Ribeiro, R. J. (2007) Model-based Geostatistics. Springer 2nd edition.

Health Informatics

- Unit 1** **Challenges of Health informatics**
- Introduction to Health informatics
 - Reading & Writing patient records
 - Creation of medical knowledge
 - Access to medical knowledge
- Unit 2** **Principles of Health informatics – Part 1**
- Representation
 - Logic
 - Clinical terms
 - Knowledge representation
- Unit 3** **Principles of Health informatics – Part 2**
- Standards in Health informatics
 - Probability and decision making
 - Probability and learning from data
- Unit 4** **Archiving Change**
- Information Technology and Organizational transformation
 - Archiving change through information
 - Archiving change through information Technology
- Unit 5** **Public Health Policy**
- Conceptual and theoretical foundations of health policy formulation
 - Implementation and analysis in the health care sector with specific applications to health informatics.

Book recommended

Taylor P, From Patient data to Medical knowledge – The principles and Practice of Health Informatics (2006); Blackwell Publishing – BMJ Books.

Books for Reading

1. Enrico Coiera Hodder Arnold , Guide to health informatics (2003) Second Edition.
2. Frank Sullivan, Jeremy C Wyatt, ABC of Health Informatics,(2006) Blackwell Publishing – BMJ Books.

Bayesian Statistics**Unit 1****Bayes law**

- Background and introduction
- The differences between Bayesian versus non Bayesian approaches;
- Baye's law for multiple events

Unit 2**Markov Chain Monte Carlo techniques**

- Introduction
- Informative priors
- Non informative priors
- Simple Gibbs sampling
- Simple Metropolis Sampling

Unit 3**Specifying Bayesian Models**

- Purpose
- Likelihood theory and estimation
- The Basic Bayesian Framework.
- Summarizing Posterior Distributions with intervals.

Unit 4**The Bayesian Prior**

- The importance of priors
- Posterior distribution
- A Plethora of priors
- Conjugate priors
- Choice of priors
- Different posterior beliefs

Unit 5**Bayesian models**

- Bayesian Hierarchical models
- Basic structure of the Bayesian Hierarchical Model
- A poison Gamma Hierarchical Model
- WinBUGS software
- OpenBUGS module

BOOKS RECOMMENDED

1. Jeff Gill, Bayesian methods: A Social and Behavioural Approach Chapman & Hall (CRC)
2. P M Lee, Bayesian Statistics: An Introduction, Arnold
3. Andrew Gelman, John B. Carlin, H.S. Stern, and D.B. Rubin, Bayesian Data Analysis, 2nd Edition. Chapman & Hall (SFGEL)
4. G R Iverson, Bayesian Statistical Inference, Beverley Hills, CA: Sage (SF4 IVE)
5. J Albert, Bayesian Computation with R, Springer 2007
6. D V Lindley, An Introduction to Probability and Statistics from a Bayesian Viewpoint (2 vols - Part I: Probability and Part II: Inference), Cambridge University Press (S 9 LIN).

BOOKS FOR READING

1. Sivia, D. and Skilling J (2006). Data analysis: A Bayesian tutorial. Oxford: Oxford University Press, 2nd edition.
2. Bernardo, J. M., & Smith, M. F. A. (1994). Bayesian theory. New York: Wiley, 1st edition.
3. Box, G. E. P., and Tiao, G. C. (1992). Bayesian inference in statistical analysis. New York: Wiley, 1st edition.

Scientific communication**Unit 1 Science Communication overview**

- What is Science Communication?
- History of Science Communication
- Goals for Science Communication
- Motivations for Science Communication

Unit 2 Oral presentation

- Single overriding communication objective (SOCO)
- Preparing a talk
- Visual aids
- Delivering a talk

Unit 3 Poster presentation

- Single overriding communication objective (SOCO)
- Preparing posters
- Visual aids
- Presenting a poster

Unit 4 Manuscript writing

- Argument matrix
- Writing style
- IMRD format
- Referencing
- Abstract writing

Unit 5 Communication through media

- Types of media
- Fundamentals of news media
- Role of news media in public health
- Soft skills for handling media

- Preparing message for print media, writing press release
- Preparing message and handling TV/radio media

BOOKS RECOMMENDED

1. Laura Bowater, Kay Yeoman, (2012): Science Communication: A Practical Guide for Scientists. ©2013, Wiley-Blackwell.
2. Bucchi, M. & Trench, B. (Eds.) (2008). Handbook of Public Communication on Science and Technology. London: Routledge.
3. Cheng, D., Claessens, M., Gascoigne, T., Metcalfe, J., Schiele, B., & Shi, S. (eds.) (2008). Communicating Science in Social Contexts: New models, New Practices. New York: Springer.
4. Joseph E. Harmon and Alan G. Gross, The Craft of Scientific Communication © 2010 (Chicago Guides to Writing, Editing, and Publishing).
5. Schimel, Joshua (2011). Writing Science: How to Write Papers That Get Cited and Proposals That Get Funded. Oxford University Press

BOOKS FOR READING

1. Marianne W. Zawitz, Bureau of Justice Statistics, Washington Statistical Society Methodology Seminars. Data Presentation: A Guide To Good Graphics.
<http://www.science.gmu.edu/~wss/methods/zawitzg.html>
2. Phil Bartle. Report Writing. <http://www.scn.org/ip/cds/cmp/modules/rep-int.htm>
3. University of Wisconsin Cooperative Extension. Communicating Results: Tips and Practices (Power Point presentation).
<http://www.uwex.edu/ces/pdande/evaluation/powerpt/TipsRS.PPT>
4. National Science Foundation. The 2002 User-Friendly Handbook for Project Evaluation. <http://www.nsf.gov/pubs/2002/nsf02057/start.htm>

Health Economics**Unit 1****Tools for Health Economics**

- Opportunity cost
- Demand and supply of health care, price elasticity of demand
- Utility functions
- Market structures, gross domestic product and inflation
- Equity and Efficiency

Unit 2**Economic evaluation in health care**

- Concept and need of health care evaluation
- Concept of efficiency and its types
- Influence of economic evaluation in policy making
- Frameworks used to prioritise different programs
- Types of economic evaluation in health care -
- Perspective of Economic Evaluation
- Interpreting CER and ICER results of economic evaluation
- Methods of economic evaluation – RCT and Decision modeling

Unit 3**Costing and cost analysis**

- Type of costs
- Perspectives of costing – Economic and financial
- Costing methods
- Designing a costing study
- Analysing cost data

Unit 4**Economic evaluation in health care**

- Valuation of benefits – DALY, QALY, WTP
- Uncertainty analysis - Types of uncertainties, analysing uncertainties
- Decision rules and thresholds - Interpreting CER and ICER results,

Unit 5**League tables and threshold**

- Introduction to league tables and thresholds

- The problem of threshold in evaluating the cost
- The limits of cost effective analysis
- Using the Drummond checklist for critical appraisal of economic evaluation

BOOKS RECOMMENDED

1. Charles E. Phelps (2009), Health Economics, Prentice Hall , 4th edition.
2. Yasodha Shanmugasundaram (1994) Theory and Practice of Health Economics in India Allied Publishers Ltd, 1st edition.
3. Government of India (1983) National Health Policy, New Delhi.
4. ICSSR AND ICMR (1981) Health for ALL 2000 A,D, ICSSR ,Delhi.
5. Naik J.P (1977) An alternative System of Health Care Services in India – Some Prospects ICSSR Delhi.
6. Panchamukhi, P.R (1980), Economics of Health: A Trend Report, Volume – VII Infrastructure, ICSSR Delhi.

BOOKS/WEB PAGES FOR READING

1. Health Economics Core Library Recommendations, 2011.
<https://www.nlm.nih.gov/nichsr/corelib/hecon-2011.html>
2. Introduction to Health economics
http://www.cartercenter.org/resources/pdfs/health/ephti/library/lecture_notes/health_sci_ence_students/LN_Intro_to_Health_Economics_final.pdf

Field Epidemiology**Unit 1****Public health situation analysis**

- Framework of situation analysis
- Data sources
- Prioritization of public health problems
- SWOT analysis

Unit 2**Disease surveillance**

- To manage and operationalise the disease surveillance system
- Conduct basic time, place and person analysis of surveillance data
- Use surveillance information for action
- Describe and evaluate a surveillance system

Unit 3**Outbreak investigations**

- Conceptualize and undertake epidemiologic and laboratory investigations of outbreaks
- Understand and undertake appropriate measures for preparation and response to outbreaks

Unit 4**Public health programme evaluation**

- Concept and purpose of evaluation
- Six steps of framework for public health programme evaluation
- Logic model
- Elements of description of health programme
- Evaluation design and tools
- Interpreting results of evaluation

Unit 5**Epidemiological Data**

- Data Interpretation
- Validity
- Reliability

RECOMMENDED BOOKS

1. Michael Gregg (2008): Field Epidemiology, Oxford University Press, USA, 2nd edition.
2. ebook selected Chapters www.ciphi.ca/hamilton/Content/documents/fieldepi.pdf
3. Mark S. Dworkin (2011) Cases in Field Epidemiology: A Global Perspective. Publisher Jones & Bartlett Learning.
4. Jones & Bartlett (2012): Learning, Methods of field Epidemiology. Publisher Michael brown.
5. Anderson RM & May RM (1992) Infectious Diseases of Humans. Dynamics and Control. Oxford Science Pubs., ISBN 0-19-854040-X.

RECOMMENDED FOR READING

1. Beaglehole R, Bonita R. (1997): Public Health at the Crossroads. Cambridge University Press.
2. Breslow NE, Day NE, Davis W. Statistical methods in cancer research (1980) Vol 1. Case-control studies. IARC Scientific Publications No 32. ISBN 9283211324
3. Clayton D, Hills M (1993). Statistical Models in Epidemiology. Oxford University Press. ISBN 019852221-5.
4. Giesecke, J (2001); Modern Infectious Disease Epidemiology. Edward Arnold ISBN 034076423-6, 2nd edition.
5. Hennekens CH, Buring JE (1987): Epidemiology in Medicine. Little, Brown & Co., ISBN 0316356360

Health Systems**Unit 1****Organization and Structure of Health System in India**

- Concept of six pillars of Health Systems - covering HS concepts, details of each of the system blocks with reference to India's health care system
- Universal Health Coverage - what it is, what is happening in the country and the issues related to it.
- Public health legislation - conceptual aspect of legislations, the various health legislations in India

Unit 2**Health Policy**

- Recognizing Policy – What is it? Who makes it? How is it made? What are its impacts? How is it evaluated? – Introducing the policy triangle framework.
- Theories of policy making – introducing the main frameworks and theories of the policy process.

Unit 3**Policy implementation**

- Policy implementation and analysis – introducing various frameworks for the analysis of policy
- Trends in the development of the health system in India. Over view of Indian Health Policy - Introducing a critical analysis of health system development

Unit 3**Health service delivery in India**

- National Health Mission
- National health programmes
- Quality systems - NABH, NABL, six sigma, ISO, Accreditation, Indian public health standards

Unit 4**Health information systems**

- HMIS and HMS
- ICD classification of diseases - Medical certification of deaths, ICD coding for hospitalizations

- Data sources for health in India

BOOKS RECOMMENDED

1. Mark Britnell, In Search of the Perfect Health System, ISBN 9781137496614
Publication Date September 2015, Publisher Palgrave Macmillan.
2. LeighAnne Olsen, Dara Aisner, and J Michael McGinnis. The Learning Healthcare System, Institute of Medicine (US) Roundtable on Evidence-Based Medicine; Washington (DC): National Academies Press (US); 2007. ISBN-13: 978-0-309-10300-8 ISBN-10: 0-309-10300-2
3. OECD iLibrary, Health Care Systems Efficiency and Policy Settings ISBN 9789264094901 (PDF) ;
DOI :10.1787/9789264094901-en http://www.oecd-ilibrary.org/social-issues-migration-health/health-care-systems_9789264094901-en
4. Corlien M. Varkevisser, Indra Pathmanathan, and Ann Brownlee Designing and conducting Health Systems Research Projects. KIT, IDRC / 2003-01-01, SBN: Out of print / 380 pg., e-ISBN: 1-55250-069-1

M_BS P01

6 hours/week

3 credits

Statistical Data Analysis I using EPI INFO/SPSS/SAS/STATA/ R

Exercise based on M_BS C01, M_BS C02, M_BS C03 and M_BS C04

M_BS P02*

6 hours/week

3 credits

Statistical Data Analysis II using EPI INFO/SPSS/SAS/STATA/ R

Exercise based on M_BS C05, M_BS C06, M_BS C07 and M_BS C08

M_BS P03*

6 hours/week

3 credits

Statistical Data Analysis II using EPI INFO/SPSS/SAS/STATA/ R

Exercise based on M_BS C09, M_BS C10, M_BS C11 and M_BS C12

***Elective subjects- in addition to the above EPI MAP/GEODA/WINBUGS will be used.**