Master of Science in Survey Research and Data Analytics

Approved by the Academic Council on 13 December 2023

(स्थापना / Established in 1956)
बेहतर भविष्य के लिए क्षमता निर्माण
Capacity Building for a Better Future

INTERNATIONAL INSTITUTE FOR POPULATION SCIENCES

[Deemed to be University)

Deonar, Mumbai 400 088. http://iipsindia.ac.in

Course Code	Course Name	Course Type	Credits	Hours	No. of Internal exam	Weightage	
						Internal exam	Semester exam
	SEMESTER-I						
MSD-F1	Understanding Demography	F	NC	45	3	50	50
MSD-F2	Social Sciences-A Primer	F	NC	45	3	50	50
MSD-C1	Mathematics and Computing- A refresher	C	3	45	3	40	60
MSD-C2	Statistical-Approaches and Avenues	C	3	45	3	40	60
MSD-C3	Acquainting with data: Surveys and Sources	C	3	45	3	40	60
MSD-C4	Sampling Methods-Basics	C	2	30	2	40	60
MSD-C5	Ways and Means of Data Collection	C	3	45	3	40	60
MSD-E1.1	Programming with R	E	2	30	2	60	40
MSD-E1.2	Analysis in STATA	E		30	2	60	40
	Semester Credits	C	**16**				
	SEMESTER-II						
MSD-C6	Data Visualization with Software	C	3	45	3	60	40
MSD- C7	Sampling Methods-Advance		2	30	2	60	40
MSD-C8	Data Quality Assessment and Management	C	3	45	3	40	60
MSD-C9	Programming for Data Analytics in Python	C	3	45	3	60	40
MSD-C10	Predictive Analytics: Theory and Practice	C	3	45	3	40	60
MSD-E2.1	Introduction to Longitudinal Data Analysis	E	3	45	3	40	60
MSD-E2.2	Methods of Decomposition	E		45	3	40	60
MSD- E3.1	Health Systems, and Policies	E	3	45	3	40	60
MSD-E3.2	Urbanization, Space and Planning	E		45	3	40	60
MSD- I	Internship on Survey Research and Data Analytics	I	2				
MSD-V1	Viva-Voce-1	V	2				
	Semester Credits		**24**				
	SEMESTER-III						
MSD-C11	Research, Ethics, and Publications	C	2	45	3	40	60
MSD-C12	Artificial Intelligence and Machine Learning Applications	C	3	45	3	50	50
MSD-C13	Program Monitoring, and Evaluation Design	C	3	45	3	40	60
MSP-C14	Analysis of Complex Survey and Estimation	C	3	45	3	40	60
MSD-C15	Field Work	C	2	30			
MSD-E4.1	Concepts and Measures of Global Health	E	3	45	3	40	60

MSD-E4.2	Health Economics and Financing	E		45	3	40	60
MSD-E4.3	Demographic Models and Indirect Estimations	E		45	3	40	60
MSD- 5.1	Population Ageing and Generational Analysis	E	3				
MSD 5.2	Population, Environment and Sustainable Development	E		45	3	40	60
MSD 5.3	Gender Analytics and Reproductive Health	E		45	3	40	60
	Semester Credits		**19**				
SEMESTER-IV							
MSD-C16	Applied Multivariate Analysis	C	3	45	3	40	60
MSD-C17	Projections and Forecasting	C	3	45	3	40	60
MSD E6.1	Spatial Analytics	E	3	45	3	40	60
MSD E6.2	Bayesian and Small area estimation Methods	E		45	3	40	60
MSD-D	Dissertation	D	10				
MSD-V2	Viva-Voce-II	V	2				
	Semester Credits		**21**				
	TOTAL CREDITS		**80**				

- *Not counted for calculating the final grade

- F – Foundation course, C – Core course, E – Elective course, NC: Non Credited course; V-Viva voce, D–dissertation.
- Semester I: One elective should be opted from E1.1/E1.2,
- Semester II: One elective should be opted from each group i.e. E2.1, E2.2; E3.1/E3.2
- Semester III: One elective should be opted from each group; i.e. E4.1/E4.2, E5.1/E5.2/E5.3
- Semester IV: One elective should be opted from E6.1/E6.2

MSD-F1 UNDERSTANDING DEMOGRAPHY

Objective: To introduce basic concepts, measures and pattern related to Demography

Course Outcome On successful completion of this course, students will be able to

1. Understand basic concepts and components of demography
2. Basic knowledge of concepts, measures and determinants of fertility
3. Working knowledge of mortality measures and life table construction
4. Understand concept, measures and determinants of migration

Course content

I. **Introduction to Demography:** Definition and Scope: Evolution of demography as a scientific discipline; Nature and scope of demography and changes in it over time. Multi-disciplinary nature of Demography, its linkage with other social science disciplines. Basic demographic concepts. Components of population change. Demographic transition (description rather than theory).

Measures of age and sex structure Defining age and sex, sex ratio, sex ratio at birth, Classification of age group and their importance, Measures of age structure: Percent distribution, Median age, age-sex pyramid, dependency ratio and potential support ratio.

Factors affecting age and sex structure, Importance of age-sex structure in Demography. Socio-economic implications of age and sex structure

II. **Fertility:** Importance of the fertility study in population dynamics; Basic terms and concepts used in the study of fertility

Basic concepts; Problems in fertility analysis; period and cohort approaches; Period measures of fertility - basic fertility measures, order-specific fertility rates, Coale's fertility indices; Cohort measures; Birth interval analysis; Reproduction measures

Determinants of natural fertility; Davis intermediate variables framework of fertility; Socio-economic determinants of proximate variables; Lee and Bulatao framework of fertility determinants; Bongaarts proximate determinants

III. **Mortality:** Need and Importance of the study of Mortality; Some basic measures: - crude death rate (CDR) and Age-Specific Death Rates (ASDRs) - their relative merits and demerits

Need and importance of standardization: direct and indirect technique of standardization of rates and ratios in the light of mortality rates; Decomposition

Infant mortality rate and its sub-divisions; Maternal Mortality Rate, Ratios, Life time risk; Issues related to estimation of maternal mortality measures

Basic concept of a life table; Types and forms of life table; Anatomy of life table; uses of life table in demographic analysis; Construction of life tables; model life tables

IV. **Migration:** Concept of mobility and migration, sources and quality of data, types of migration, census definition of migrants, limitations

Internal migration patterns and characteristics in developing countries with a special focus on India; Determinants of internal migration: Causes of migration at the place of origin and at the place of destination; Patterns of international migration: Historical and recent trends; causes and consequences of international migration

Direct estimation of lifetime and inter-censal migration rates from census data; Indirect measures of net internal migration: Vital Statistics Method, National Growth Rate Method and Census and

Life Table Survival Ratio methods; Methods of estimating international migration; Migration surveys

Essential Reading List

1. Bhende, A., (1996): Principles of Population Studies (Seventh Edition), Himalaya Publishing House, Bombay.
2. Davis, Kingsley (1968). The Population of India and Pakistan, Russell and Russell, New York.
3. Jacob S. Siegel and David a. Swanson (2004): The Methods and Materials of Demography, Second Edition, Chapters 1, 2, 3, 7, 9,10, Elsevier Science, USA.
4. Shryock, Henry S. Jacob S. Siegel and Associate, (1980): The Methods and Materials of Demography Vol.1 & 2, U.S. Bureau of the Census, Washington D.C.
5. John R. Weeks, (2005), Population: An Introduction to Concepts and Issues,Nineth Edition, Wadsworth Publishing Company, Belmont, California.
6. Pathak, K.B. and F.Ram, (1998) Techniques of Demographic Analysis, Mumbai: Himalaya Publishing House, Chapter 4, Pp.108-153.
7. Asha A. Bhende and Tara Kanitkar, (2003), Principles of Population Studies,
8. Sixteenth Revised Edition, Himalaya Publishing House, Mumbai.
9. Hinde, Andrew (1998) Demographic Methods. London: Arnold.
10. United Nations, (1974): Methods of Measuring Internal Migration, Manual VI, UN, New York.

Suggested Reading List

1. Rowland, Donald T. (2006), Demographic Methods and Concepts. New York: Oxford University Press.
2. Yaukey, David. 1985. Demography: The study of Human population. St. Martins, New York.
3. Coale, Ansley J. and Paul, Demney (1983): Regional Model Life Tables and Stable Populations, Academic Press, New York.
4. United Nations (1982): Model Life Tables for Developing Countries, United Nations, NewYork.
5. United Nations, (1979): “Trends and Characteristics of International Migration Since 1950” Demographic Studies No. 64, UN, New York.

MSD-F2 SOCIAL SCIENCES-A PRIMER

Objective: To build foundation on social sciences including Sociology, Psychology, Geography, and Economics

Course Outcomes On successful completion of this course, students will be able to

1. Understand concepts of sociology, society, culture and social change.
2. Acquire basic understanding of Social Psychological Concepts including Psychoanalysis, Personality Motivation, Attitude, Behaviour, Learning and Communication Processes

Course Contents:

I. SOCIOLOGY

Sociology: sociology as a social science- its nature, subject matter and scope Relation of sociology with other social sciences, sociological perspective. Basic Concepts in sociology

The Family: Sociological Significance of the Family; Types and functions of Family; Nuclear and joint families

Marriage: Different forms of marriage, changing patterns of marriage/mate selection in India

Kinship –features of kinship system in India, regional variations

Social stratification : Social Class and Caste: Principles of Class and Caste

Socialization : agencies of socialization

Culture: meaning and characteristics of culture.

Society and Culture in India

Aspects of society and culture in India, and its role and importance in Population Studies.

Social Institutions and their role in influencing demographic situation of the Population of India - Family, Marriage, Kinship and Religion

Caste System

Concept and definition of Caste System, Changing Caste System in India

Social Mobility : vertical and horizontal, intra- and inter-generational mobility

Social Change

Definition and Concept of Social Change. Process of Social and Cultural Changes in India and their role in influencing demographic behaviour: a) Sanskritization b) Westernization c) Modernization

II. Social Psychological Concepts:

Psychology as a Discipline: Branches and dominant Psychological thoughts
Psychoanalysis: Cognitive Behaviour,
Social Psychological Concepts and its relevance to Population Studies
Personality Motivation, Attitude, Behaviour,
Learning and Communication Processes: Concept, Meaning, Scope, and need in the Context of Population Studies.

III. GEOGRAPHY

Importance of Geographical factors- Physical factors (relief, rainfall, temperature, soil and vegetation) Economic and Social factors (Mineral resources and industrialisation, transport, language, religion and caste/tribe); the influence of geographical factors on population.

Geographical approaches: the concept of region- formal and functional regions; the concept of growth pole and regional development; core and periphery; distance and decay function; Maps- scale, choropleth, isopleths and distribution maps.

Physical divisions of India; administrative organization of India. Historic-Cultural regions; Agro-climatic regions; NSS regions.

Theoretical Perspectives in Geography- Place of geography in Social sciences; man and nature relationship- determinism and possibilism; Positivism (quantification) and Phenomenology; and Radical and Postmodern Geography.

Concept of Social Space; Social Structure and Spatial Structure; Role of time and space in social sciences.

IV. ECONOMICS

Introduction:

Defining Economics, Micro and Macro economics, Economic and non economic good, Basic Economic Activities, Factors of Production, Economic Systems.

Basic Concepts in Micro Economics

Concept of Marginal and Total Utility, Law of Diminishing Marginal Utility, Theory of Demand: Indifference curves Theory and Properties, Equilibrium of consumer, Income, Substitution and Price effect. Elasticity of Demand: Price, Income and cross elasticity, Basic concepts in theory of production, cost and market structure.

Basic Concepts in Macro Economics

Basic Concepts in National Income: Concept of GDP, NDP, GNP, NNP, NI, PCI, GDPPCI, PPP, GDPPCI (PPPUS$), Theory of consumption and saving: Consumption function, Keynes' Psychological law of consumption, concept of APC and MPC, APS and MPS, Factors affecting consumption and savings, Basic concept of Investment.

Economic Theories

Political economy and protectionism – Mercantilism, Classical economics and free enterprise – Adam Smith and David Ricardo, Welfare economics – Alfred Marshall and Amartya Sen, Karl Marx and the Labour theory of Value, Empirical economics – Paul Samuelson.

Indian Economy: Structure, Planning and Growth

Characteristics of Indian Economy: Economic Transition in India, Strategy of economic planning in India, Industrial Policy 1956, 1977 and 1991, New Economic Reforms- 1991, Other Development issues: Poverty and Unemployment.

Essential Reading List

1. Davis, Kingslay, Human Society, MacMillan and Co., New York, (1975), Chapters 1, 3,5,6.
2. Kapadia, K. M., Marriage and Family in India, Oxford University Press, Calcutta, (1966).

3. Mandelbaum, D.G., Society in India-Continuity and Change(vol.1) and Change and Continuity, (Vol. 2). University of California Press, London, (1970).
4. Mac Iver R.M. and Charles H. Page, Society: An Introductory Analysis, Holt, Rinehard and Winston, New York, (1949), Chapters No.1, 3,7,11,15,22,24,25,26.
5. Srinivas M.N., Social Change in Modern India, University of California Press, Berkeley, (1966)
6. Haralambos, Michael, Sociology: Themes and Perspectives, Oxford University Press, Delhi (1980).
7. Ahuja H.L, Advanced Economic Theory: Microeconomic Analysis, S. Chand and Company Limited, New Delhi, Chapters 5,6,7,8,9,12,16, 17, 18, 20
8. Koutsoiannis A, 1979, Modern Microeconomics, London: Macmillan Press Ltd,
9. Lipsey and Chrystal, 2004, Economics, Oxford university Press, Part One, part two and part five
10. Dasgupta AK, Epochs of Economic Theory, OUP, Bombay, Chapters 2, 3, 4, 7 and 8
11. Datt R and Sundaram K.P.M, 2000, Indian economy, S. Chand & Company Ltd, Part II.
12. Abler, R, Adams, J and Gould P., (1971): Spatial Organization: The Geographer's view of the World, Prentice Hall, New Jersey.
13. Johnston, R.J., (2004): Geography and Geographers, Oxford Unity Press.
14. Richard, Peet., (1998): Modern Geographic Thought, Blackwall Publishers
15. Singh, R.L., (1971) India: A Regional Geography, National Geographical Society of India, Varanasi.
16. Francis John Monkhouse (1956) Maps and Diagrams: Their Compilation and Construction, University of Michigan.
17. JF Friedman (1966) Regional Development Policy: A Case Study of Venezuela, Cambridge, Massachusetts : MIT Press, 1966.

Suggested Reading List

1. Kuppuswamy B., Social Change in India, Konark Publication Pvt. Ltd. Delhi, (1972).
2. Muzumdar, Haridas , The Grammar of Sociology: Man in Society, Asia Publishing House, Mumbai (1966).
3. Johnson, Harry M, Sociology : A Systematic Introduction , Allied publishers, Bombay (1966).
4. Mc Gee , Reece , Sociology: An Introduction , Holt, Rinehard and Winston, New York (1980).
5. Magill ,Frank N (ed.), International Encyclopedia of Sociology, Fitzroy Dearborn Publishers, London, (1995).
6. Samuelson, Paul A. and William D. Nordhaus.,, "Economics", New York: Tata McGraw Hill, part one, two and five
7. Blaugh, M., 1962. "Economic Theory in Retrospect", London: Heinemann Ltd.
8. Haney, Lewis H., 1960, " History of Economic Thought", New York: Macmillan
9. Government of India, Ministry of Finance, Economic Division, Economic Survey, 2001-2002
10. Sigmund Freud, The Interpretation of Dreams (1900)
11. Charles M. Duhigg, The Power of Habit (2012)
12. Karen Horney, The Neurotic Personality of Our Time (1937)
13. Oliver Burkeman, The Antidote: Happiness for People Who Can't Stand Positive Thinking

(2012).

14. Carl Gustav Jung, Man and His Symbols (1964)
15. Introduction to Psychology 10th Edition James W. Kalat (2013)

MSD-C1 MATHEMATICS AND COMPUTING- A REFRESHER

Objective: To comprehend students with knowledge of basic mathematics and computational techniques which are essential to build foundation for survey research methods and data analytics.

Course Outcome: On successful completion of this course, the students will be able to

1. Understand basic concepts of metrics linear algebra which will be useful in data analytics
2. Acquire knowledge of numerical methods which is essential basic knowledge for understanding dynamics of data
3. Understand basic concepts of functions, equations and their solutions
4. Introduced basic computational concepts and software R.

Course Content

I: Set Theory and Vector: Sets, Types of Sets, Basic Operations on Sets, Venn diagram, Cartesian product of two sets, Distributive law, De Morgan's Law, Definition of functions, Domain and Range, Increasing and decreasing functions, Concavity of functions, Types of vectors, Vectors in 2d and 3d planes, vectors in Rn, Vector addition, scalar multiplication and their properties, Dot product, cross product and their applications, Orthogonality

II: Matrices Matrix, Submatrix, types of matrices, symmetric, square, diagonal matrices, singular and non-singular matrices. Addition, Subtraction, multiplication of matrices, Rank of matrix. Trace, Determinants Transpose, Inverse, eigenvalues, eigenvectors

III Vector space: Definition of vectors spaces over real numbers, Subspaces of a vector space, Linear span of vectors, linear dependence and linear independence, Basis and dimension of vector spaces, linear transformation, The matrix of Linear Transformation, Rank Nullity theorem, change of basis and similar matrices

IV: Numerical Methods: Factorial, finite differences, and interpolation. Operators, E and divided difference. Newton's forward, backward and divided differences interpolation formulae. Lagrange's interpolation formulae. Central differences, Gauss and Stirling interpolation formulae. Constant change and linear growth, Equation of lines, Linear functions and graphs, Quadratic, Exponential, and Logarithmic Functions, derivatives. Solutions to differential equations

V **Basic concepts for computations:** Events, variable, measurement scale of variable, Person-time, Proportion, Ratio, Rate, and Probability, Period, cohort measures, incidence, prevalence

VI. Introduction to Computer Programming: Introduction to computer programs, algorithm, editor, Compiler and Interpreter, Programming Environment: Basic Syntax, Variables and Data Type, Keywords, Basic Operators, Loops, Number, Characters, Arrays, Strings and Functions.

Introduction to R: Installation, importing data, calculations, numbers, vectors, objects, arrays and metrices, dataframe

Readings:

1) Kolman, Busby and Ross, PHI, Discrete Mathematical Structure.
2) Malik S.C. and Savita Arora: Mathematical Analysis, Second Edition, Wiley Eastern Limited, New Age International Limited, New Delhi, 1994.
3) Gentle J.E. Matrix Algebra : Theory, Computations and Applications in Statistics. Springer Science+Business Media, LLC, New York, 2007.
4) Goel B. S. and Mittal S. K.: Numerical Analysis, Pragati Prakashan, ND,2008
5) Jain, M. K., Iyengar, S. R. K. and Jain, R. K. (2003): Numerical methods for scientific and engineering computation, New age International Publisher, India.

MSD-C2 STATISTICAL-APPROACHES AND AVENUES

Objective: This course aims to provide students with basic knowledge of statistical techniques which is essential to build foundation for survey research methods and data analytics.

Course Outcome:

1. Learn basic measures of central tendency and dispersion
2. Working knowledge of probability distribution
3. Knowledge of concept of correlation and regression and interpretations of coefficients
4. Know basic concept of inferential statistics, including choosing appropriate statistic to test hypothesis

Course Contents:

I. Introduction to statistics:

Descriptive and Inductive statistics. Concept of variables, Nominal, Ordinal and Interval and ratio scale variables. Presentation of data, conversion of raw data into frequency distribution, graphical presentation of nominal, ordinal data,

Measures of Central Tendency:

Mean (arithmetic, geometric, harmonic) Median, Mode; Merits and demerits of different measures.

Measures of dispersion:

Range, Variance, Standard Deviation; Merits and demerits of different measures of dispersion. Measures of Skewness and Kurtosis.

II. Introduction to probability:

Definition of probability, Events: exhaustive, mutually exclusive events; Laws of probability, additive and multiplicative laws of probability, Bayes' theorem with application

Discrete probability distribution:

Binomial and exponential functions, Binomial probability distribution and Poisson distribution and their properties.

Continuous probability distribution:

Introduction to Normal distribution and its properties, applications of normal distribution.

III. Correlation & Regression:

Definition of correlation, scatter diagram, Pearson correlation coefficient, and its properties; Spearman ranks correlation coefficient. Concept of linear regression, fitting of regression line.

IV Statistical Inference Introduction to Statistical Inference, Types of data and variables, Basic principles of statistical inference, The role of probability in statistical inference

A: Estimation

1. Concept of population, random sample, parameter, statistic, estimator, sampling distribution of random sample, joint and marginal distribution of functions of random variables.
2. Role of normal distribution in statistical inference, law of large numbers, Central Limit Theorem, sampling from normal distribution- Chi-square distribution, F- distribution, Student's t distribution and their properties.
3. Methods for finding estimators-method of moments, maximum likelihood, method of minimum Chi-square, properties of estimators: mean square error (MSE), minimum MSE, unbiasedness and minimum variance unbiased estimator (MVUE), Cramer-Rao lower bound of variance, relative efficiency of estimator.
4. Concept of confidence interval, confidence interval for- mean, difference in means, variance, methods of finding confidence interval- pivotal quantity and statistical methods.

B: Testing of Hypothesis

1. Statistical hypotheses- simple and composite, statistical tests, critical region, Type I and Type II errors, size and power of test.
2. Definition of most powerful (MP), and uniformly most powerful (UMP) tests, power functions of tests with illustration, Neyman- Pearson lemma and its application in hypotheses testing regarding binomial, Poisson, normal and exponential distributions.
3. One sample and two sample test for mean, test for a binomial proportion; Score test versus Wald; Exact binomial test; Tests for differences in binomial proportions; Intervals for differences in binomial proportions.
4. Introduce Fisher's exact test; Chi-squared test for equivalence of two binomial proportions; Chi-squared tests for independence; Chi-squared tests for goodness of fit; Hypothesis tests of marginal homogeneity; Estimating marginal risk difference; Estimating marginal odds ratios; Distinction between conditional and marginal odds ratios.
5. Need for non-parametric test, sign test for location of univariate and bivariate populations, Wilcoxon-Mann-Whitney test, run test, median test, and test based on Spearman's rank correlation.

2: Estimation

- Point estimation and interval estimation
- Properties of estimators

- Confidence intervals and their interpretation

3: Hypothesis Testing

- Basic concepts of hypothesis testing
- Types of errors and power
- One-sample and two-sample hypothesis tests

4: Likelihood-Based Inference

- Maximum likelihood estimation
- Likelihood ratio tests
- Goodness-of-fit tests

5: Nonparametric Inference

- Basic concepts of nonparametric inference
- Nonparametric density estimation
- Nonparametric hypothesis testing

6: Advanced Topics in Inference

- Bootstrap methods for inference
- Permutation tests
- Model selection and regularization

7: Applications and Software

- Applications of statistical inference to real-world problems
- Statistical software for inference ()
- Interpretation and communication of statistical results

Reading List

1. Bhat N.R and M.R. Singh, 1993. *Applied Mathematics*. New Delhi: Tata McGraw – Hill Publishing Company Ltd.
2. Blalock, Hubert M. (1960): *Social Statistics*, McGraw-Hill Book Company, New York.
3. Chakravorti, S.R. and Giri, N. (1997): *Basic Statistics*, South Asian Publishers, New Delhi.
4. Clarke, G.M. and Cooke, D.,(1994): *A Basic Course in Statistics*, Arnold, London.
5. Dillon, W.R. and Goldstein, M. (1984): *Multivariate Analysis*, John Willey and Sons, New York.
6. Dixon, W.J and Massey, F.J. (1983) *Introduction to Statistical Analysis*, 4th ed., New York, MC Graw Hill, 380-381, 534.
7. Douglas and Altman (2006): Practical Statistics for Medical Research, Chapman and Hall

Publication, Washington, D.C.
8. Ebdon, E. (1978): Statistics in Geography, Basil Blackwel, Oxford.
9. Fisher, L.D and Van Belle, G. (1993) Biostatistics : A Methodology of the Health Sciences, New York, Wiley Intgescience,
10. George Casella and Roger L. Berger "Statistical Inference" by (3rd edition)
11. Goon, A.M., Gupta, M.K. and Dasgupta, B. (1985): *Fundamental of Statistics* Vol. I , The World Press Private Ltd. Calcutta.
12. Graeme Hutcheson and Nick Sofroniou, (1999): *The Multivariate for Social Scientist,* SAGE Publications.
13. Gupta, S.C. and Kapoor, V.K. (1986): *Fundamental of Mathematical Statistics*, Sultan Chand and Sons Publishers, Delhi.
14. Hogg, R.V and Craig, A.T.: Introduction to Mathematical Statistics, Fourth edition. Collier Macmillan Publisher.
15. Howell David C. *"Fundamental Statistics for the Behavioral Sciences",* 4th Edition, an International Thosuross Publishing Company, USA.
16. Jack Lee. "Inference Principles for Biostatisticians
17. Jain, S.K.1979. *Basic Mathematics for demographers*. Canberra: The Australian National University.
18. Larry Wasserman "All of Statistics: A Concise Course in Statistical Inference"
19. Lipshutz, Seymour., *Schaum's Outline Theory and Problems of Set Theory and Related Topics* Series, Mcgraw Hill.
20. Marcello Pagano and Kimberlee Gourneau (2000) "*Principles of Biostatistics*" Second Edition, Duxbury Thomson Learning, United States.
21. Mc Clave, James T., P. George Benson and Terry Sincich (2001): *Statistics for Business and Economic,* Eighth Edition, Prentice Hall, NJ, USA.
22. Mood, A.M., Graybill, F.A., and Boes, D.C. : Introduction to the Theory of Statistics, Third edition. McGraw Hill.
23. Norman R. Kurtz (1999): *Statistical Analysis for the Social Sciences,* Allyn and Bacon.
24. Prakasam, C.P., G. Rama Rao, and R.B. Upadhyay (1987): *Basic Mathematics in Population Studies*, Gemini Publishers, Mumbai.
25. Retherford, R.D. and Choe, M. K., (1993): *Statistical Models for Casual Analysis*, A Wiley-Inter-Science Publications, John Wiley and Sons, INC, New York.
26. Roa, C.R.: Linear Statistical Inference and Applications, Revised edition. Wiley Eastern.
27. Siegel J.J. and D.A. Swanson (Ed.), 2004. *The Methods and Materials of Demography*. Second Edition. Elaevier Academic Press.
28. Sundaram, K. R., S. N. Dwivedi and V Sreenivas. (2009). Medical Statistics-Principles & Methods. Anshan Publisher.
29. Venkatachary, K (1994). *Elements of Mathematics for Demographers*. Monograph Series No.9. Regional Institute for Population Studies, University of Ghana. Legon.

MSD-C3 ACQUAINTING WITH DATA: SURVEYS AND SOURCES

Objectives: To introduce different data sources and provide an overview of Demographic and Population health surveys across the globe and India.

Course Outcome

1. Working knowledge of the Census, registration system, and history of demographic data sources
2. To comprehend the need, objectives and importance of large-scale data in monitoring and evaluation of health and population policies and programmes
3. Introduced global and national importance surveys
4. Understand the stages of completing a useful and appropriate survey.

I. History of Demographic and Health data Sources

Paris registers, Population registers, Census, Vital registration data, Bills of mortality, Fiscal documents, Military records, Inventories of properties, Genealogies, Marriage practices, Archaeological remains, Administrative geography, Colonization of new land, Cemetery data, Traveler's tales.

II. Population Census and Registration System

Population Census: Population census across the world. Census taking under British India, Indian census, details of different items on which Indian census collect data, enumeration method, publications of census data/ reports.

Registration system: Vital registration system, Civil registration system, Sample registration system (SRS), survey on causes of death, HMIS.

III. Scope of large-scale survey and its phases

Need for large scale surveys, objectives of cross-sectional, longitudinal, rotational and intepenetrating surveys, representativeness. Planning, sampling design, developing data collection tools, field implementation, data process, analysis, report writing and dissemination

IV. Introduction to Demographic, Population Health surveys

Global surveys: World Fertility Survey (WFS); Demographic Health Survey (DHS); Multiple Indicator Cluster Survey (MICS); World Health Survey (WHS); Health and retirement Survey (HRS); Study om Global Ageing and Adult Health Survey (SAGE)

Nationwide large-scale surveys: National Sample Survey Organization's surveys, details of different rounds collecting population and health data; National Family Health Survey (NFHS); District Level Household and Facility Survey (DLHS); Annual Health Survey (AHS); Longitudinal Ageing study in India Survey; Study on Global Aging and Adult Health Survey (WHO-SGAE)-India; Global Youth Tobacco Survey (GYTS); Global Adult Tobacco Survey; YOUTH survey; Nutritional Specific Surveys

Reading List:

1. United Nations (2005): Household Sample Surveys in Developing and Transition Countries.
2. www.unstats.un.org/unsd/hhsurveys/
3. Family Health International: Behavioral Surveillance Surveys. Family Health International, 2000.

4. Bhende, A., (1996): Principles of Population Studies (Seventh Edition), Himalaya Publishing House, Bombay. Davis, Kingsley (1968).
5. Jacob S. Siegel and David a. Swanson (2004): The Methods and Materials of Demography, Second Edition, Elsevier Science, USA.
6. John Weeks (2005): Population: An Introduction to Concepts and Issues, Wordsworth Learning. Singapore 9th edition.
7. Livi-Bacci, M. (1996): A Concise History of World Population (2nd edition), Oxford.
8. Maheshwari, S.R. (1996). The Census Administration under the Raj and After, Concept Publishing Company Pvt. Ltd., New Delhi.
9. Registrar General of India, Census of India -2011, Ministry of Home Affairs, Govt. of India. United Nations (1958). Multilingual Demographic Dictionary, John Wiley & Sons Ltd., New York.
10. United Nations, (1973): The Determinants and Consequences of Population Trends, Vol. I, Population Studies, No. 50, Chapter VII, New York.
11. World Population Prospects

MSD-C4	SAMPLING METHODS-BASICS

Course Outcomes:

CO1: Gain understanding of basic concepts related to sample surveys with specific references to health and demographic surveys.

CO2: Gain understanding of basic sample survey designs.

CO3: Learn skills to design and implement sample surveys in keeping with research objectives.

1. Concept of sampling: Concept of population and sample, need for sampling, sample survey verses census, elementary units, sampling units, assumptions of sampling from finite population, sampling frame, selection and inclusion probabilities, probability and non-probability sampling, concept of sampling mechanism and sampling design. Overview of complex surveys, Types of sampling methods, Probability sampling designs, Nonprobability sampling designs
2. Sample size computation

Sample size calculations using estimation targets based on relative standard error, margin of error, and power requirements; Use of mathematical programming to determine sample sizes needed to achieve estimation goals for a series of subgroups and analysis variables, Methods of sample allocation for multistage samples;

3. Simple Random Sampling with and without replacement
    - Estimation of population means and totals
    - Sampling error and variance estimation

4: Stratified Sampling

- Estimation of stratum means and totals
- Optimal allocation of sample size
- Weighting methods for unequal selection probabilities

5. **Systematic random sampling**: Concept of systematic sampling, comparison with simple random sampling, variance estimation, comparison with stratified random sampling, systematic sampling, selection procedure for fractional interval, circular systematic sampling.

6. Use of auxiliary information, ratio and regression methods of estimation under simple random sampling, bias, mean square error, and ratio and regression estimators in stratified random sampling.

7. Cluster Sampling

- Definition and properties of cluster sampling
- Estimation of population means and totals
- Design effects and variance estimation

Readings:

1. Cochran, W.G. (1977). Sampling Technique, Third edition. New York: John Wiley& Sons.
2. Damico, A. Step-by-step instructions to analyze major public-use survey data sets with the R language
3. Des Raj (1972).The design of samplesurveys. McGraw Hill
4. Fares Qeadan. Sampling Methods Using STATA
5. Kish, Leslie, (1995): Survey Sampling, John Wiley and Sons, Inc. New York.
6. Ladusingh, L. (2018). Survey Sampling Methods, PHI Learning, New Delhi
7. Lohr L. Sharaon., (1999): Sampling: Design and Analysis, Duxbury Press, London.
8. Lumley, T. Complex Surveys: A Guide to Analysis Using R
9. Murthy, M.N. (1977). Sampling Theory and Methods, 2nd Edition. Calcutta: Statistical Publishing Society.
10. Roy, T.K., Acharya R., Roy, A.K. (2016). Statistical survey design and evaluating impact,
11. Cambridge University Press, New Delhi.
12. Sukhatme, P.V. and Sukhatme, B.V. (1970). Sampling Theory of Surveys with Applications. Asia Publishing

MSD-C5	**WAYS AND MEANS OF DATA COLLECTION**

Objective: To comprehend students with working knowledge of data collection methods, questionnaires and software

Course outcome

1. Understand different interview techniques and methods of data collections
2. Able to design checklist and guidelines for qualitative data collection
3. Understand questionnaire structure and standards for large scale quantitative surveys
4. Working knowledge of software used for data collection

Course content

Data collection and Interview Techniques*:* Mail method, interviews through telephone, internet and computers, face-to-face interviews or personal, self-administered and interview administered questionnaire, Quantitative vs. qualitative data collection, Principles and guideline for interview, language.

Qualitative Methods of data collection: In-depth interviews, key informant interview, observation (participatory and non-participatory), focus group discussion, content analysis, social

mapping, social networking, free listing, pile sorting, projective techniques, mechanical devices (camera, tape recorder), mystery client technique, vignettes method.
Software for Qualitative Research: ANTHROPAC, Atlast Ti and Group Work
Questionnaire Development for quantitative surveys: Types of Questionnaire/schedule, Checklist schedules, structure of questionnaire, roster, skipping non applicable questions, checks. Standardization of tools, Principles of constructing a questionnaire/ interview schedule, Types of questions (knowledge, attitudinal, behavioral, practice), framing of questions (simple, delicate, personal matter), sequencing of questions. Updating/developing new questions. Testing survey tools: Pretest. Translation in regional language
Attitude Scales: Point scales, ranking scales, rating scales, limitations of attitude scales, Types of Scales: Bogardus, Guttman, Likert, Semantic, Thurstone scale.
Software for Data Collection in large scale surveys: Computer assisted personal interview (CAPI), process of data transfers, introduction to features of Census and Survey Processing System (CSPro), steps for development of data entry software in CSPro; Web-designed questionnaires.
Ethical consideration in Data Collection: Informed Consent, approvals from institution review board
Field visits and Group work

Reading List:

1. CSPro Software. www.census.gov/data/software/cspro.Download.htm
2. United Nations (2005): Household Sample Surveys in Developing and Transition Countries.
3. www.unstats.un.org/unsd/hhsurveys/
4. DHS Manuals
5. NFHS Manual for interviewer
6. LASI manual for interviewer
7. Manual for CAPI used in NFHS

MSD-E1.1 PROGRAMMING WITH R

Course Outcomes:

CO1: Learn open source softwares R for data analysis.

CO2: Learn exploratory data analysis with R.

CO3: Learn use of R programming for model development.

Unit I: Introduction

Introduction to R/RStudio; advantages of R over other programming languages; R packages for data science

Unit II: Importing dataset

Understanding the data; importing and exporting data; getting started analyzing data; accessing database

Unit III: Data Visualization

Histogram; boxplots; bar charts; line graphs; heat map; scatterplots; pie charts; customize plot axes, labels, add legends, and add colors

Unit IV: Data manipulation

Pre-processing data; handling missing values; data formatting; data normalizing; grouping data values into bins; converting categorical variables into numerical quantitative variables

Unit V: Exploratory data analysis

Computation of measures of central tendency and dispersion; computation of correlation coefficient; chi-square test for association between two categorical variables

Unit VI: Model development

Linear regression, multiple linear regression, binary logistic regression; ordinal logistic regression

Essential Reading List

1. Gareth James, Daniela Witten, Trevor Hastie, and Robert Tibshirani, Introduction to Statistical Learning with Applications in R, Springer 2013. Available free online.
2. Christian Kleiber and Achim Zeileis, Applied Econometrics with R, Springer-Verlag, New York, 2008.
3. Download and install R from https://cran.r-project.org/
4. Download RStudio from www.rstudio.com
5. Video Tutorials on Installing R on windows
6. Video Tutorials for Installing R on Mac

MSD-E1.2 ANALYSIS in STATA

Course Outcomes:

CO1: Familiarity with STATA for data analysis.

CO2: Learn model development in STATA.
CO3: Learn use of STATA for survey data analysis.

Unit I: Introduction to STATA
Facilities, creating database structure, data entry, specifying scales, validation of data entry, importing and exporting data.

Unit II: Importing dataset
Understanding the data; importing and exporting data; getting started analyzing data; accessing database

Unit III: Data visualization
Histogram; boxplots; bar charts; line graphs; heat map; scatterplots; pie charts; customize plot axes, labels, add legends, and add colors

Unit IV: Data manipulation
Recoding; creating new variable; sorting; filtering and selection of specific data; merging files; generating simple frequencies; use of syntax editor; handling missing values

Unit V: Exploratory data analysis
Computation of measures of central tendency and dispersion; computation of correlation coefficient; chi-square test for association between two categorical variables

Unit VI: Model development
Linear regression analysis - interpretation and regression diagnostic test; regression models for binary outcomes, categorical, and ordinal outcomes

Unit VII: Survey data analysis
Introduction; need for using survey data commands; estimation of means, proportions, ratios, totals; regression models for binary outcomes, categorical, and ordinal outcomes

Essential Reading List

1. StataCorp. 2021. STATA user's guide, release 17. College Station, TX: StataCorp LLC.
2. StataCorp. 2021. STATA survey data reference manual, release 17. College Station, TX: StataCorp LLC.

MSD-C6	DATA VISUALIZATION WITH SOFTWARE

Objective: To introduce Microsoft power BI and R for data visualization and interactive dashboards.

Course outcomes

1. Develop data visualization and infographics thinking
2. Create interactive dashboards using Microsoft Power BI
3. Prepare attractive and meaningful graphs, maps using different software

I. Data-Analytic Thinking and infographics

Knowing your data, Different types of data, Data pre-processing, Storytelling with data, infographics, making dashboards, Understanding the concepts of dynamic/interactive data visualization and report generation.

II. Data Visualization from Different Sources

Understanding structured, unstructured and semi-structured data sources, Data modelling and creating visualization, Data modelling and creating visualization, charts/dashboards from semi-structured data like CSV files, XML, JSON and others, Data modelling and creating, visualization charts/dashboards from live streaming data.

III. Data visualization with Power BI

Introduction to Power BI, data import, cleaning, building data models, creating visualization, types of visualization, Identify the differences between filters and slicers in a Microsoft Power BI, Customize the filter pane for reporting needs, Making interactive dashboards.

IV. Data Visualization With R

Introduction to R programming, R studio projects, Visualization using R, Transformation using R, Exploratory data analysis, Data manipulation with dplyr (introduction to dplyr package), Data visualization with plot, ggplot2, Data presentation with R Markdown.

Reading List:

1) Zhou A. (2022). Data Visualisation in R, Quantitative Methods in Global Health. URL https://cdn1.sph.harvard.edu/wp-content/uploads/sites/2488/2022/09/Data-Visualization-in-R.pdf
2) Long, J. D., & Teetor, P. (2019). R cookbook: proven recipes for data analysis, statistics, and graphics, CA: O'Reilly. URL: https://rc2e.com/
3) Core Python Programming - Second Edition, R. Nageswara Rao, Dreamtech Press
4) R Graphics Essentials for Great Data Visualization by Alboukadel Kassambara
5) Wickham, H. and Grolemund, G. (2016): R for Data Science Import, Tidy, Transform, Visualize, and Model Data. O'Reilly.
6) Lander, J.P. (2017): R for Everyone-Advanced Analytics and Graphics. Pearson Education
7) Gandrud, C. (2020): Reproducible Research with R and R Studio. 3rd edition, CRC Pres

MSD-C7	Sampling Methods-Advance

Course Outcomes:

CO1: Gain understanding of complex sample survey designs.

CO2: Know and appreciate the sampling design of large-scale surveys conducted in India.

CO3: Learn estimation of sampling errors in large-scale surveys

CO4: Become aware about the concept of sampling weights and estimation and application of sampling weights in large-scale surveys.

Unit I: Advanced concepts

Use of auxiliary information, ratio and regression methods of estimation under simple random sampling, bias, mean square error, and ratio and regression estimators in stratified random sampling.

Unit II: Multi-stage designs

Introduction; two-stage design; selection of sampling units at different stages; estimation of mean and sampling variance; design effect; intra-class correlation; probability proportional to size sampling

Unit III: Examples of sampling design of large-scale surveys
National Family Health Survey; Longitudinal Ageing Study in India; Sample registration System; National Sample Survey Organization

Unit IV: Estimating sampling errors in large-scale surveys
Taylor series linearization method; replication approach - the Jackknife repeated replication method, balanced repeated replication

Unit V: Sampling weight
Description; computation of sampling weight under different designs; self-weighting designs; post-stratification

Unit VI: Nonsampling errors
Introduction; coverage error; non-response error; response error

Unit VII: Use of STATA and R for sampling and estimates: Sampling and estimation by simple random sampling, stratified, cluster, systematic and cluster sampling, PPS sampling using STATA and R. Introduction to STATA for survey data analysis-SVYSET, SVYTAB, SVYMEAN, SVYPROP, SVYTOTAL, SVYLC. Introduction to R: reading ASCII file, data summarization: frequency and graphical representation, survey data summarization using R. Installation of libraries: sampling, survey, samplingbook, pps. Use of svydesign, svytotal, svymean.

Reading List

1. Kish, L. (1995). Survey Sampling. New York: John Wiley and Sons, INC.
2. Roy, Tarun Kumar, Acharya, Rajib, and Roy, Arun Kumar (2016). Statistical Survey Design and Evaluating Impact. Delhi, India: Cambridge University Press.
3. United Nations (2005). Household Sample Surveys in Developing and Transition Countries. New York: United Nations.
4. Ladusingh, Laishram (2018). Survey Sampling Methods. Prentice Hall India.
5. Cochran, W.G. (1977). Sampling Technique, Third edition. New York: JohnWiley & Sons.

MSD-C8	DATA QUALITY ASSESSMENT AND MANAGEMENT

Objectives: In this course students learn the assessment of quality of demographic and health data with special focus on age data, missing values, and outliers. After completion of this course students are expected to get the following outcomes

Course Outcomes:

1. Demonstrate an understanding of the theoretical basis of survey measurement and measurement error;

Identify appropriate survey design strategies for a range of measurement challenges

2. Vision to judge the quality of data, comment on it and adjust the data.

3. Learn data processing, including handling missing data and outliers

4. Familiarize to large-scale survey data handling software (STATA).

Course Content

I. **Data Quality Assessment:** Reliability and validity of measurement: Face, content, construct, convergent, concurrent, and predictive validity; Inter-coder reliability, stability, non-random and random errors, scaling and composite indices.

Appraisal of the quality of demographic and health data; Completeness of registration data Types of errors, coverage and content errors. Sources of errors.

Examples of data on survey, and census and registration data affected by errors; sampling and non-sampling errors; methods of detecting errors in population data;

Evaluation and measurement of errors in age reporting; methods of adjustment for age-sex data; method of graduation.

Post-enumeration surveys; dual record system.

Techniques of evaluation of age data using Whipple's index, Myer's index, UN Joint score

II. **Quality assurance procedures in survey**

Building Checks in data collection tools for consistency in responses, spot check, Revisit of sub-samples, field check tables, Use of AI/ML in data quality assurance, digitization of survey process, non-response pattern, and quality lot assurance, roles of supervisors, editors, field and nodal agencies. Third party audit.

III. **Large scale data processing and conversion**: process from data collection, validation, cleaning, editing to recoding., conversion to different file format, Conversion of ASCII/ CSPro data into STATA or other formats.

IV. **Handling Missing Data:** Assessment of missing data: missing at random, logical, non-response pattern, bias, replacing missing data, imputations by average, by regression method

V. **Data Management in Software:** Introduction to STATA -facilities, creating database structure, data entry, specifying scales, validation of data entry, importing and exporting data. Reshape data structure and merging files.

VI. Data manipulation using STATA – recoding creating new variable, sorting, filtering and selection of specific data, generating simple frequencies, use of syntax editor.

VII. Commands in SQL, data types in SQL, data manipulation and data processing with SQL

Reading List:

1. Bhat P.N.M., (2002): Completeness of India's Sample Registration System: An assessment using the general growth balance method, Population Studies, 56 (2002), 119-134, Printed in Great Britain.
2. Seigel Jacob S. and David A. Swanson (eds.) (2004): The Methods and Materials of Demography. 2nd Edition, New York: Elsevier Academic Press. Chapters 20 & 21.
3. Stata user's guide: Release 10., 2nd Edition. Stata Press
4. Stata survey data reference manual: Release 8., 2nd Edition. Stata Press.

MSD-C9	PROGRAMMING FOR DATA ANALYTICS IN PYTHON

Objective: To introduce the basic and advanced programming in Python.

Course Outcome: On successful completion of this course, the students will be able to

1. Demonstrate the programming skills in Python
2. Apply the Python programming for data visualization, and analysis

Course Content

I. **Introduction to Python:** Basic Programming in Python: Python Basics, Flow Control, Functions, List, Dictionaries. Automating Tasks Using Python: Pattern Matching with Regular Expressions, Reading and Writing Files, Organizing Files, Debugging, error handling.

II. **The NumPy ndarray**: a multidimensional array object, creating ndarrays, data types for ndarrays, arithmetic with numpy arrays, basic indexing and slicing, transposing arrays and swapping axes, universal functions: fast element-wise array functions, array-oriented programming with arrays, file input and output with arrays, pseudorandom number generation. introduction to pandas data structures, series, data frame, Web Scraping.

III. **Data cleaning and preparation**: handling missing data, data transformation, string manipulation. data wrangling: hierarchical indexing, combining and merging datasets, reshaping and pivoting.

IV. **Introduction to Jupyter Notebook**, Basic libraries for data visualization: NumPy, Pandas, Matplotlib, Plotly, Seaborn, GGplot, Geoplotlib (for handling geographical data).

V. *Matplotlib:* Introduction to Matplotlib, Basic plots using matplotlib, Specialized Visualization Tools using Matplotlib, Advanced Visualization Tools using Matplotlib, Waffle Charts, Word Clouds.

VI. *Seaborn:* Seaborn functionalities and usage, Spatial Visualizations and Analysis in Python.

VII. Introduction to modeling libraries in python: interfacing between pandas and model code, creating model descriptions with patsy, introduction to statsmodels, scikit-learn.

Readings:

1. David J. Pine (2019): Introduction to Python for Science and Engineering. CRC Press.
2. Jake vanderPlas (2017): Python Data Science Handbook – Essential Tools for Working with Data.O'Really Media.
3. Johansson, R.(2019):Numerical Python-Scientific Computing and Data Science Applications withNumPy, SciPy and Matplotlib. A press.
4. Jake vanderPlas (2017): Python Data Science Handbook – Essential Tools for Working with Data.O'Really Media.
5. Johansson, R.(2019):Numerical Python-Scientific Computing and Data Science Applications withNumPy, SciPy and Matplotlib. A press.

MSD-C10	PREDICTIVE ANALYTICS: THEORY AND PRACTICE

Objective: To introduce prediction-based modelling based on advanced regression analysis.

Course outcomes: On successful completion of this course, the students will be able to

1. Formulate linear models in the field of data science.
2. Fundamental knowledge of predictive models.
3. Choose appropriate model by understanding nature of data and regression diagnostics.
4. Test regression diagnosis and choose appropriate model using R and STATA

Course Content:

I. Linear regression model
II. Generalized regression model
    Binary outcome
    Categorical more than 2 response
    ordinal
    Count data
III. Model diagnostics
IV. **Fitting Regression in STATA/R** Linear regression model, Generalized regression model: Binary outcome, Categorical more than 2, response, ordinal, analysis of Count data
V. **Regression diagnostics in STATA**: Postestimation commands for different regression analysis, residuals,
VI. **Modelling in R**: model basics with modelr, visualizing models, formulas and model families, model building, many models with purrr and broom, gapminder, creating list-columns, making tidy data with broom, making tidy data with broom.

Readings:

1. Gujarati, DN and Sangeetha (2007). *Basic Econometrics* (Fourth Edition), TataMcGraw Hill, New Delhi
2. Retherford, R.D. and Choe, M. K., (1993): *Statistical Models for Casual Analysis*, A Wiley-Inter-Science Publications, John Wiley and Sons, INC, New York.
3. Wickham, H. and Grolemund, G. (2016): R for Data Science Import, Tidy, Transform, Visualize, and Model Data. O'Reilly.
4. Lander, J.P. (2017): R for Everyone-Advanced Analytics and Graphics. Pearson Education.
5. Wickham, H. (2014): Advanced R. CRC Press.
6. Gandrud, C. (2020): Reproducible Research with R and R Studio. 3rd edition, CRC Press
7. STATA manual and help for regression diagnostics

MSD-E2.1 INTRODUCTION TO LONGITUDINAL DATA ANALYSIS

Course Outcomes:

CO1: Learn basic concepts and examples of longitudinal data.

CO2: Learn models frequently used for analyzing longitudinal data.
CO3: Learn longitudinal data analysis using STATA/SAS.

Unit I: Introduction and basic concepts

Exploring longitudinal data, Examples of longitudinal studies, Features and characteristics of longitudinal data statistics, Descriptive methods, Criteria, Causality, Repeated measurements, Clustering, Missing data issues.

Unit II: Examples of Longitudinal Data

Young Lives Study; Health and Retirement Study; British Cohort Study; India Human Development Survey

Unit III: Linear Models

Overview of linear models, Distributional assumptions, Modelling the mean and covariance, Maximum likelihood estimation, Statistical inference, Variance and covariance, Fixed-effects models, Random-effects models, Baseline response, Biasness in mean and variance, Diagnostic and residual analysis

Unit IV: Generalized Linear Models (GLM)

Review of Generalized linear model (GLM), Moments and characteristic functions, Weighted GLM, Conditional GLM models, Estimation of Marginal models, Generalized Estimating Equations, Residual and diagnostics analyses.

Unit V: Longitudinal Data Analysis using software

Essential Reading list:

1. Garrett M Fitzmaurice, Nan M Laird and James H Ware. Applied longitudinal analysis; John Wiley & Sons.
2. Diggle, P., Heagerty, P., Liang, K. Y., & Zeger, S. (2002). Analysis of longitudinal data. Oxford University Press.
3. Davis, C. S. (2002). Statistical methods for the analysis of repeated measurements. Springer Science & Business Media.

Suggested Reading list:

1. Walter W Stroup. Generalized linear mixed models: modern concepts,

methods and applications; CRC Press.
2. Helen Brown and Robin Prescott. Applied mixed models in medicine; John Wiley & Sons.
3. Brady T West, Kathleen B Welch and Andrzej T Gatecki. Linear mixed models; CRC Press.
4. Weiss, R. E. (2005). *Modeling Longitudinal Data: With 72 Figures*. Springer Science & Business Media.
5. Brown, H., & Prescott, R. (2015). *Applied mixed models in medicine*. John Wiley & Sons.

MSD-E2.2 METHODS OF DECOMPOSITION

To be prepared

MSD-E3.1	HEALTH SYSTEMS AND POLICIES

Course Outcomes:

CO1: To develop capacity among students to analyze health systems from an international and comparativeperspectives.
CO2: To provide a historical orientation to the students on Indian-scenario; national health policy, health caredelivery system, national health programmes and health sector reforms.
CO3: To understand the need and relevance of health legislations as an instrument of protection and promotionof public health and inculcate the ability to critically review them.
CO4: To introduce the students to health policy and systems research, and recent developments.

Unit 1: Basic Concepts: Concepts of Health; Public health; Community health; Preventive and curate health; Health promotion; Health services; and Primary, secondary and tertiary care.

Unit 2: Health System: Goals, boundaries, functions, and WHO's health system building blocks: service delivery, health workforce, health Information systems, access to essential medicines, financing and leadership/ governance.

Unit 3: Health Services: Basic models and functions of health services, international experiences and goals and elements in universal health care (UHC) approach.

Unit 4: Health care system in India: public sector, private sector, voluntary sector, human resources for health, access to health care, utilisation and expenditure on health services, and UHC initiatives and challenges ahead.

Unit 5: Health policy: Concepts and tools of health policy, health policy stakeholders, health policy triangle framework, rational decision making to approach to health policymaking, introduction to health policy and systems research.

Unit 6: Health policymaking in India: Health planning in post-Independent India, national health policies, national health policy 2017, and current national health programmes.

Unit 7: Regulation in the health sector: Need for regulations, mechanisms for regulation, key legislations and standards in the health sector in India, and challenges in the implementation of regulations.

ESSENTIAL READING LIST

1. Abel-Smith, Brian. An introduction to health: policy, planning and financing. Routledge, 2018.
2. Murray, Christopher JL, and Julio Frenk. "A framework for assessing the performance of health systems." Bulletin of the World Health Organization 78 (2000): 717-731.
3. Rao, K. Sujatha. Do we care?: India's health system. Oxford University Press, 2016.
4. Government of India. 2017. National Health Policy-2017. New Delhi: Ministry of Health and Family Welfare, Government of India.

SUGGESTED READING LIST

1. Balarajan, Yarlini, Selvaraj Selvaraj, and S. V. Subramanian. "Health care and equity in India." The Lancet 377, no. 9764 (2011): 505-515.
2. Central Bureau of Health Intelligence. National Health Profile 2021 (or the latest year). New Delhi: Central Bureau of Health Intelligence, Ministry of Health and Family Welfare, Government of India.
3. Gilson, Lucy, and World Health Organization. Health policy and system research: a methodology reader: the abridged version. World Health Organization, 2013.
4. Montagu, Dominic, and Catherine Goodman. "Prohibit, constrain, encourage, or purchase: how should we engage with the private healthcare sector?." The Lancet 388, no. 10044 (2016): 613-621.
5. Mossialos, Elias, Martin Wenzl, Robin Osborn, and Dana Sarnak. 2015 International profiles of health care systems. Ottawa, ON, Canada: Canadian Agency for Drugs and Technologies in Health, 2016.
6. Murray, Christopher JL, and David B. Evans. "Health systems performance assessment: goals, framework and overview." *Health systems performance assessment: Debates, methods and empiricism* (2003): 3-23.
7.
8. Nandraj, S., Gupta, P., & Randhawa, S. (2021). Regulation of Health Care Delivery in India - A Landscape Study, Health Systems Transformation Platform, New Delhi.
9. National Statistical Office. Key Indicators of Social Consumption: Health (July 2017–June 2018). New Delhi: National Statistical Office, Ministry of Statistics and Programme Implementation, Government of India. 2019
10. Peters, D.H., 2018. Health policy and systems research: the future of the field. Health Research Policy and Systems, 16(1), pp.1-4.
11. World Health Organization. *A vision for primary health care in the 21st century: towards universal health coverage and the Sustainable Development Goals*. No. WHO/HIS/SDS/2018.15. World Health Organization, 2018.
12. Walt, Gill, and Lucy Gilson. "Reforming the health sector in developing countries: the central role of policy analysis." Health policy and planning 9, no. 4 (1994): 353-370.

MSD-E3.2 URBANIZATION, SPACE AND PLANNING

Course Outcomes:

CO1: Developing a comprehensive understanding on concepts of space, place and region.
CO2: Understanding the history of urban planning and its illustration in Indian context.
CO3: Acquainting students with theories of regional development and various strategies of regional planning.
CO4: Developing a critical understanding on urban policies and progammes in India
CO5: Providing students a practical knowledge of Geographical Information Systems and its utility in regionaland urban planning.

I. Urbanization and Space

Urbanization and space: Definitions and concepts of urban areas & urbanization. Concepts and forms of formal and informal spaces; Differences between space, place and region; urbanization and space interaction: gravity model, distance decay model, forces of concentration and dispersion, urban agglomeration and spatial economy; Access and right to the city

II. Evolution of Spaces of Settlements

Settlement: evolution, characteristics and factors; settlement pattern and hierarchy; Urban morphology; Change in urban land use and population density; Rural-urban relationship: dichotomy or continuum; Role of urban centres in rural development.

III. Urban and Regional Planning

Planning: Definitions, concepts, purpose, types and levels; geography/demography and planning relationship.

Regional development/planning: Region: concept and definition, types (formal, functionaland planning); Need for regional planning; Types of regional planning; Spatial structure of regions,

Theories of regional development: Stages of development, economic base theory, Industrial location theory, Growth Pole theory; Core-periphery interactions.

Regional planning in India; Planning regions in India; Regional disparity in development; causes and consequences, North-Eastern regional council, Mumbai Metropolitan Regional Development Plan.

Urban Planning: Concepts; history and origins of urban planning; pioneers of urban planning; types of urban plans: New towns, neighborhood, garden city, green belts; healthy urban planning, WHO concept of healthy city, livable city, sustainable city.

Urban policy since independence, important urban plans (New Delhi, Navi Mumbai, Chandigarh, Gandhinagar, Bhubaneshwar); Smart Cities Mission; HRIDAY, AMRUT, PURA, RURBAN

mission

IV. Challenges in Urban planning

Recent urban policies and programmes; Urban redevelopment; Urban poverty, urban housingand real estate, Slums and slum rehabilitation, The case of Slum Rehabilitation Authority (SRA) in Mumbai; Urban pollution,Solid waste management; Management of migrants

V. Remote Sensing, GIS and Urban and Regional Planning
Application of Remote Sensing and GIS in urban and regional planning.

Essential Reading List

1. Friedman, John and William Alonso (1964) *Regional Development and Planning: A Reader*,The MIT Press, Massachusetts.
2. Friedman, John (1966) *Regional Development Policy: A Case Study of Venezuela*, MIT Press,Massachusetts.
3. Chaudhuri, J. R. (2001) *An Introduction to Development and Regional Planning*, Orient Longman, Hyderbad.
4. Chand, M and V.K. Puri, (1983), *Regional Planning in India,* Allied Publishers Private Ltd, New Delhi
5. Mishra, R.P, (1992), *Regional planning: Concepts, Techniques, Policies and Case studies*, Concept Publishing Co., New Delhi

Suggested Reading List

1. Bhagat, R. B., Roy, Archana K. and Sahoo, Sahoo. (2020). *Migration and Urban Transition in India: A Development Perspective*. Routledge India, New Delhi.
2. Kumar, A. and Bhagat, R. B. (2021). *Migrants, Mobility and Citizenship in India*. Routledge India, New Delhi.
3. Lefebvre, H (1991). *The Production of Space*, Blackwell, Oxford.
4. Hall, P, (1992), *Urban and Regional Planning*, Third Editions, Routledge, London.
5. Harvey, D. (2012) *Rebel Cities: From the Right to the City to the Urban Revolution*, Verso, London

8. Husain, M, (1994), *Human Geography*, Rawat Publishing, Jaipur.
9. Leong, Goh C. and G.C. Morgan, (1982), *Human and Economic Geography*, Oxford University Press, Singapore.
10. Singh, R. Y. (1994), Geography of settlements, Rawat Publications, Jaipur.
11. Ginsburg, N., Bruce Koppel and T.G. Mc Gee (1991) *The Extended Metropolis: SettlementTransition in Asia*, University of Hawaii Press, Honolulu.
12. Nath, V. (1971) "Regional Development Policies", Economic and Political Weekly, 6(30-32):1601-1608.
13. Lo, C.P. and Yeung, A. K. W. (2002): Concepts and Techniques of Geographic InformationSystems. Prentice Hall of India, New Delhi.
14. Nyerges, Timothy L. and, Jankowski Piotr (2010): Regional and Urban Gis: A DecisionSupport Approach, Rawat Publication, Jaipur.

15. Friedman, J and Clyde Weaver, (1979), *Territory and Function: The evolution of regionalplanning*, Edward Arnold, London.

16. Kawashima, T and P. Korcelli, (1982), *Human Settlement Systems: Spatial Patterns and Trend*, IIASA, Luxemburg.

17. Knowles, R and J. Warling, (1983), *Economic and Social geography: Made Simple*, Heinemann, London.

18. Sarin, M, (1982), *Urban Planning in the Third World: The Chandigarh Experience*, Manshell, London.

19. MMRDA (2016), Mumbai Metroplotan Regional Development Plan 2016-2036 MMRDA,Mumbai.

20. UNEP and others (2007), Livable Cities: The benefits of environmental planning, The CitiesAlliance, Washington. http://www.citiesalliance.org/idex.html.

MSD-C11 RESEARCH, ETHICS AND PUBLICATIONS

Course outcomes

1. To understand the research design and scientific approaches to conduct of research in varied settings.
2. Aware of different types of publications, search engines, copyrights.
3. Understand research, publication and data ethics.

I. Philosophy of Research

- Law, Theory, and Model
- Overview on Main Assumptions and Arguments of Selected Social Theories (functionalism, conflict theory, symbolic interactionalism, system theory, feminist theories, change theories)
- Causation and Research Design
- Criterion of causation

Nomothetic casual explanation
Idiographic casual explanation

II. Need for Research and its phases

Definition of Research, Assumptions, Operations and Motivations and Aims of Scientific Research. The Research Process: conceptual, Empirical and Analytical Phases of Research.

II. Research Designs

Conceptual vs. Empirical; Quantitative vs. Qualitative, Observational Studies: Descriptive, Analytical studies, explanatory, and exploratory, Experimental Studies: Pre-test design, post-test design, Follow-up, longitudinal design, Action research studies, Panel Studies; evaluative studies.

III. Research Process

Defining and formulating the research problem, selecting the problem, necessity of defining the problem, importance of literature review in defining a problem, literature review, identifying gap areas from literature and research database, development of working hypothesis, conceptual framework, sampling, developing tools, data collection, process, analysis, report writing

IV Research Publications

Overview of different type of research articles: -primary and secondary sources, reviews, monograph, patents, research databases, web as a source, searching the web, critical literature review, journals, books, publishers, impact factor, reference style

V. Ethics in Research

Ethics of Research, History of ethical guidelines and general principles Informed consent and human subject protection ICMR ethical guidelines for biomedical research on human participants The Biomedical research on human subjects -regulation, control and safeguards

Ethical issues in data collection and willingness to pay

Ethics in Data Analytics/computing

Data obfuscation, encryption, confidential computing, privacy implementation.

Scientific Misconduct and Publication ethics

falsification, fabrication, and plagiarism, Selective reporting and misrepresentation of data. practices/standards setting initiatives and guidelines, Conflict of interest, Violation of publication ethics, copyright and sharing policies

Essential Reading List

1. Bernard, H. Russell, (1995): Research Methods in Anthropology: Qualitative and Quantitative Approaches, Altamira Press, Walnut Creek.

2. Goode W J and Hatt P K. 1952. Methods in Social Resasrch. McGraw Hills, New York.

3. Kish, Leslie, (1995): Survey Sampling, John Wiley and Sons, Inc. New York.

4. Lohr L. Sharaon., (1999): Sampling: Design and Analysis, Duxbury Press, London.

5. Mukherji, P.N., (1999): Methodologies in Social Science, Sage Publications, New Delhi.

6. Royce A. Singleton and Bruce C. Straits, (1999): Approaches to Social Research, Oxford, Oxford University Press.

7. Young P V. 1994. Scientific Social Surveys and Reasearch. Prentice-Hall, New York (4th Edition).

MSD-C12	ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING APPLICATIONS

Objective: To provide conceptual knowledge and applications of AI and ML.

Course outcome:

1. Describe the concepts of AI and machine learning
2. Visualize the applications of AI and ML in public health interventions and data analytics
3. Apply the machine learning tools in data science.
4. Develop technological foundation of cloud computing

Course Content:

I. **Basic concepts of Big Data:** Concept of Big Data, 5**V**s, Data Science, Machine Learning (ML), Deep learning (DS), Artificial Intelligence (AI). Survey data vs. digital data – advantages and disadvantages

II. **Application of AI** for planning and monitoring of public health and welfare programmes, Healthcare informatics, Telemedicine, digital health, surveillance. Chatbots

III. **Relational Database Management Systems:** SQLite with R, MariaDB with R on amazon EC2 instance, PostgreSQL with R on amazon RDS.

IV. **Digital trace data and cloud computing:** Digital trace data from social media, websites, Introduction to Cloud Computing, Migrating into a Cloud, Monitoring, Management and Applications, Data Security in the Cloud, Legal Issues in Cloud computing.

V. **Machine Learning:** concepts, Types of machine learning – supervised, unsupervised, reinforcement learning. Regression vs. classification problem, algorithm vs models, Basics of machine learning model building, train-test split, model evaluation, ROC curves, application of machine leaning in health, public health and demography, Advantages and disadvantages of ML.

VI. **Models in machine learning** –Basics of Decision Trees, trees vs linear models, Random Forest, fitting of classification and regression trees, support vector machines, Clustering (K-nearest neighbours, PCA), Neural Networks.

Reading List:

1) Tom Mitchell, “Machine Learning”, McGraw Hill, 1997
2) E. Alpaydin, “Introduction to Machine Learning”, PHI, 2005.
3) Andrew Ng, Machine learning yearning URL: https://nessie.ilab.sztaki.hu/~kornai/2020/AdvancedMachineLearning/Ng_MachineLearningYearning.pdf
4) Russell, Norvig, Artifificial Intelligence: A Modern Approach, Third edition, Prentice Hall,2010
5) Burger, S.V. (2018): Introduction to Machine Learning with R: Rigorous mathematical modeling. O Reilly.
6) Lantz, B. (2019): Machine Learning with R: Expert Techniques for Predictive Modeling. Packt Publications, 3rd edition

7) Lewis, N.D. (2017): Machine Learning Made Easy with R: An Intuitive Step by Step Blueprint for Beginners. CreateSpace Independent Publishing Platform.
8) Vecciola, B. and Selvi (2017): Mastering Cloud Computing: Foundations and Applications Programming. Tata McGraw Hill.
9) Rittinghouse and Ransome (2009): Cloud Computing: Implementation, Management and Security. CRC Press,
10) Doss, A. (2013): Cloud Computing.Tata McGraw Hil

MSD-C13	PROGRAM MONITORING, AND EVALUATION DESIGN

Course Outcomes: After completing the course, students will be able to-

1. Develop M & E framework and Statistical Analysis Plan
2. Demonstrate an understanding of the essential principles and design of Program evaluation
3. Learn statistical methods used in evaluation Program
4. Understand Ethical issues in evaluation research
5. Understand public interventions related to health and family welfare

I. Introduction to Monitoring and Evaluation: Basic concepts, Difference between Monitoring and Evaluation; Linkage between Planning, Monitoring and Evaluation; Importance of Monitoring and Evaluation, Databased decision making

II. Monitoring and Evaluation Framework: Resources for monitoring and evaluation, Engagement of stakeholders in monitoring and evaluation; Meaning of Indicators, Ideal requirement, process of developing indicator, illustration of indicators developed from large scale surveys, measurement, need & levels of indicator; Challenges in developing indicators from Large-Scale Surveys; Types of Indicators – Input, Process, Output, Outcome, Impact; Learning and accountability of Monitoring and evaluation data

III. Monitoring of Policy Implementation: Components of policy and programme, budget, staff, process of evaluation, developing tangible indicators for policy monitoring in terms of Input, Process, Output, Outcome, Impact; Result based inference

IV. Evaluation in Theory: Principles, norms and standards for evaluation; Criterion for evaluation; Theory of Change; Evaluating for results; Roles and responsibilities in evaluation; Scaling Impact

V. Evaluation Design: Determination of sample size under different approaches and design including measurement of change due to certain interventions; Quasi Experiment design, Case control design, Evaluation Terms of Reference, Formative and Summative Evaluations, Managing Evaluations; Evaluation at different points: Baseline, Mid-point, Concurrent and End line evaluation; Randomization, Statistical design of Randomization; Randomized control trials, time dependant cluster design, interrupted time series analysis.

VI. Assuring the Quality of Evaluation Design and Methodology: Overview; Defining the context; The evaluation purpose; Focusing the evaluation;

Evaluation methodology; Mandatory requirements for programme; SWOT analysis of NHM, ICDS and National Livelihood Mission; Social audit – meaning, objectives, advantage, case study of social audit

VII. Statistical Approaches of Evaluation of Intervention Programme: Statistical inferences used in different intervention design – z, t, F and paired 't' tests, two stage LSM, instrument variable method; Propensity score matching; Difference in Difference Method: Theory and application, advantage and disadvantage, regression implementation, Decomposition analysis

VIII. Healthcare Informatics: MIS – Monitoring information system; Role of programmers; HMIS system; Global Positioning System, Management Information System and Use of Technology, Use of Artificial Intelligence, tele-interventions, Use of spatial data

IX. Group work and presentation on Health and family welfare Program evaluation: review program, SWOT analysis, preparing M&E framework/choosing framework indicators and methods for evaluation

Reading List

1. Casley, Dennis J and Kumar, Krishna (1988). *The Collection, Analysis, and Use of monitoring and Evaluation Data.* A World Bank Publication, The John Hopkins University Press
2. FHI (2004). *Introduction to Monitoring and Evaluation Monitoring and Evaluation, monitoring hiv/aids programs: A facilitator's training guide.* Family Health International
3. GoI & UNDP (2012). *Guiding Framework for Monitoring and Impact Evaluation of Capacity Building &Training of Panchayati Raj Institutions in States/UTs.* Government of India and United Nation's Development Programme
4. IFRC and RCS (2002). *Handbook for Monitoring and Evaluation*. International Federation of Red Cross and Red Crescent Societies –Geneva
5. McLean R. and Gargani J. (2019) Scaling Impact Innovations for the Public Good. Routledge, New York.
6. NIRD&PR; MoRD and TISS (2016). *Social Audit: A manual for Trainers*. National Institute of Rural Development & Panchayati Raj; Ministry of Rural Development and Tata Institute of Social Sciences
7. OECD (2021). Applying Evaluation Criterion Thoughtfully, OECD Publishing, Paris. https://doi.org/10.1787/543e84ed-en.
8. Rossi, Peter H.; Mark W. Lipsey and Howard E. Freeman (2004). Evaluation, A Systematic Approach. Seventh Edition. Sage Publications – New Delhi.
9. Sullivan, T.M., Strachan, M., and Timmons, B.K. (2007). *Guide to Monitoring and Evaluating Health Information Products and Services.* Baltimore, Maryland: Center for Communication Programs, Johns Hopkins Bloomberg School of Public Health; Washington, D.C.: Constella Futures; Cambridge, Massachusetts:
10. Management Sciences for Health, 2007.
11. United nations development Group. The Theory of Change, UNDAF Campanion Guideline.

MSD-C14	ANALYSIS OF COMPLEX SURVEY AND ESTIMATION

1: Multistage Sampling

Definition and properties of multistage sampling, Estimation of population means and totals, Sampling weights and variance estimation, Multi-stage sampling with examples, Methods of variance estimation for complex sample designs, including the Taylor series expansion method, balanced repeated replications, and jack-knife methods, Bootstrap methods for complex sample designs and how to incorporate those methods into inference for complex sample survey data. the effect of stratification and clustering on estimation and inference, alternative variance estimation procedures;

2: Weighting and Imputation Methods

- Development and handling of selection and other compensatory weights; methods for handling missing data; methods for incorporating weights, stratification, clustering, and imputed values in estimation and inference procedures for complex sample survey data;
- Nonresponse and missing data in complex surveys
- Weighting adjustments for nonresponse and noncoverage
- Imputation methods for missing data

- Steps in weighting, including computation of base weights, non-response adjustments, and uses of auxiliary data;
- Non-response adjustment alternatives, including weighting cell adjustments, formation of cells using regression trees, and propensity score adjustments;
- Weighting via post-stratification, raking, general regression estimation, and other types of calibration.
- Examples- NFHS, SRS, NSSO, Sero-surveillance

3: Model-Based Inference

- Model-assisted and model-based estimation
- Regression models for complex survey data
- Incorporating design effects into regression models

4: Design-Based Inference

- Variance estimation for complex survey data
- Survey data analysis using statistical software
- Generalized design effects and variance functions.

5. Weighting and Variance Estimation

- Weighting adjustments for unequal probabilities of selection
- Variance estimation in complex surveys

Readings:

1. Heeringa, S. G., West, B. T., & Berglund, P. A. (2017). Applied survey data analysis (2nd ed.). Chapman and Hall/CRC.

2. "Applied Survey Data Analysis" by Steven G. Heeringa, Brady T. West, and Patricia A. Berglund (2nd edition, 2017)

3. "Sampling of Populations: Methods and Applications" by Paul Levy and Stanley Lemeshow (5th edition, 2015)

4. "Model Assisted Survey Sampling" by Carl-Erik Särndal, Bengt Swensson, and Jan Wretman (1992)

5. "Survey Methodology" by Robert M. Groves, Floyd J. Fowler Jr., Mick P. Couper, James M. Lepkowski, Eleanor Singer, and Roger Tourangeau (2nd edition, 2011)

MSD-E4.1 CONCEPTS AND MEASURES OF GLOBAL HEALTH

Ojectives: This paper introduces to the students the basic concepts of global health. This course emphasizes on understanding the global burden of disease and measuring population health. A key component of this course is to understand the determinants of health and health disparities. It will also provide student with a broad understanding of the relationship between environment and health. It also develops the understanding of the students about the health care delivery system, human resources for health, migration of human resources for health, etc. Finally, it introduces to students the issues related to policy and health.

Course Outcomes:

CO1: To familiarize the students with the emerging concepts, measures, and significance of global health incontemporary world.

CO2: To understand the global mortality transition in terms of it varied features like cause of death, populationage structure and differential quality of life.

CO3: To understand the impact of poverty, inequality on disease prevalence, health infrastructure, deprivationfor the mortality divide and its repercussions.

CO4: To introduce and understand impacts of environmental factors and recommend public health measuresneed to be taken to mitigate health effect of climate change.

CO5: To recommend appropriate public health intervention in keeping with disease burden and evaluate healthsystem performance in international perspective.

Course Contents

I. Concept and introduction: Concept of global health; why is it important to study global health?; health and development in the global context; demographic, health and epidemiological transitions; major patterns of distribution of disease in the world; sources of data on disease and disability

II. Global burden of disease: Concept of burden of disease; hypotheses related to burden of diseases – compression of morbidity, expansion of morbidity and dynamic equilibrium; measures of burden of disease at the population level – health expectancy and health gap; methods for estimating DFLE, HALE and DALY; how does the burden of disease and mortality vary by geography, social class, race and gender? GBD 1990, 2010 and 2013 – changes and continuities; new and re-emerging infectious diseases; issues related to HIV/AIDS; introduction to NCDs; double burden of diseases in

developing countries; impact of tobacco abuse; trends and challenges related to maternal and child health; maternal mortality

III. **Determinants of Health**: Culture, gender, race, social, political and economic determinants of health and health disparities; contribution of income, education and other factors to health; Factors responsible for variation in the global burden of disease across countries; poverty and health; income inequality and health; health risk factors

IV. **Environment and health**: Role of water, sanitation, indoor and outdoor air pollution and nutrition in explaining global health disparities; climate change and health; migration, disaster (man-made, natural), conflicts and epidemics

V. **Health care delivery systems**: Introduction to health systems; how to measure performance of health system?; health systems in different countries; factor responsible for better performance of health systems in developed countries; the distribution of human resources for health; quality of human resources for health; the push and pull factors associated with the migration of health care providers

VI. **Policy and health**: Human rights approach to health; national and international policies related to health; how are global health priorities set?; the role of international actors like WHO, World Bank, etc. in global health; influence of international priorities on national priorities

Reading List

Essential readings :

1. Skolnik, R. (2008). Essentials of global health, Jones and Bartlett: Sudbury, MA.
2. Jacobsen, K.H. (2007). Introduction to global health, Jones and Bartlett: Sudbury, MA.
3. Markel, W.H., Fisher M., Smego R. (2007). Understanding global health, McGraw Hill: Columbus.
4. Merson, M.H., Black, R.E., Mills, A.J. (2001). International public health: diseases, programs, systems and policies, Gaithersburg, MD: Aspen Publishers.
5. Murray, C.J.L., Saloman, J.A., Mathers, C.D., Lopez, A.D. (2002). Summary measures of population health: concepts, ethics, measurement and applications, The World Health Organization: Geneva.
6. Murray, C.J.L., Saloman, J.A., Mathers, C. (2000). A critical examination of summary measures of population health, Bulletin of the World Health Organization 78(8): 981-994.
7. Cutler, D., Deaton, A., Lleras-Muney, A. (2006). The determinants of mortality, Journal of Economic Perspectives 20(3): 97-120.
8. Link, B.G., Phelan, J. (1995). Social conditions as fundamental cause of disease, Journal of Health and Social Behavior 35: 80-94.
9. Smith, J.P. (1999). Healthy bodies and thick wallets: the dual relation between health and economic status, Journal of Economic Perspectives 13(2): 145-166.
10. Shiffman, J. (2009). A social explanation for the rise and fall of global healthissues, Bulletin of the World Health Organization 87(8): 608-613.
11. Gwatkin, D.R. (2000). Health inequalities and the health of the poor: what dowe know? What can we do? Bulletin of the World Health Organization 78(1): 3-18.
12. Laxminarayanan, R. et al. (2006). Advancement of global health: key messagesfrom the Disease Control Priorities Project, Lancet 367(9517): 1193-1208.
13. Murray, C.J.L., Frenk, J. (2000). A framework for assessing the performance ofhealth systems, Bulletin of the World Health Organization 78(6): 717-731.
14. Mills, A., Rasheed, F., Tollman, S. (2006). Strengthening health systems, InDisease Control Priorities in Developing Countries (2nd Edition), pages 87-102, New York: Oxford University Press.

15. Hsiao, W.C. (2003). What is a health system? Why should we care? HarvardSchool of Public Health Working Paper.
16. Anand, S., Baernighausen, T. (2004). Human resources and health outcomes: across country econometric study, Lancet 364(9445): 1603-09.
17. Chen, L. et al. (2004). Human resources for health: overcoming the crisis, Lancet364(9449): 1984-1990.
18. Pallikadavath, S., Singh, A., Ogollah, R., Dean, T., Stones, W. (2013). Humanresource inequalities at the base of India's public health care system, Health & Place 23: 26-32.
19. Zurn, P., Dal Poz, M.R., Stilwell, B., Adams, O. (2004). Imbalance in the healthworkforce, Human Resources for health 2(13): 1-12.
20. Willis-Stattuck, M. et al. (2008). Motivation and retention of health workers indeveloping countries: a systematic review, BMC Health Services Research 8: 1-8.
21. Brown, T.M., Cueto, M., Fee, E. (2006). The World Health Organization andthe transition from 'international' to 'global' public health, American Journal of Public Health 96(1): 62-72.
22. Ruger, J.P. (2005). The changing role of the World Bank in global health,American Journal of Public Health 95(1): 60-70.
23. Ravishankar, N. et al. (2009). Financing of global health: tracking developmentassistance for health from 1990-2007, Lancet 373(9681): 2113-2124.
24. London, L. (2008). What is a human-rights based approach to health and does itmatter? Health Human Rights 10(1): 65-80.

MSD-E4.2	HEALTH ECONOMICS AND FINANCING

Course Outcomes:

1. To introduce various concepts on economic gradient of health and demand for and supply of health care.CO2: To explain various measures on socio-economic inequality in health.
2. To familiarize the means and measures of health financing.
3. To understand the determinants of health insurance and its coverage.
4. To introduce the methods and measures on economic evaluation of health care.

I: **Introduction to Health Economics**

Defining health economics, why health economics is important, basic concepts in microeconomics, health across world and over time, scope of health economics, map of health economics, basic questions confronted by health economist, concept of efficiency and equity in health, Production Possibility Frontier (PPF), economic gradient of health, causation of income and health, Preston Curve, economic models and analysis, expenditure function, Theories of X and Y, positive and normative economics.

II. The Demand for Health and Health care

What is Health and Good Heath, Utility Analysis, Health as a form of human capital, What is Medical Care, The production of Good Health, Empirical evidences in the production of health, Health as human

capital, Grossman Model, The Demand for Health Care, Demand function for health, Economic and non-economic factors of health care, Fuzzy Demand Curve, Price and income elasticity of demand for health care, Important consideration in estimating health care demand elasticity, provider's behavior, Empirical findings, externalities and market failure.

III. **Health Financing**

Health financing in low, middle and high income countries, demographic transition, epidemiological transition and health expenditure, disparity in disease burden and per-capita health spending, sources of health care in India, out-of-pocket expenditure on health care, catastrophic health expenditure, approaches in measuring catastrophic expenditure, impoverishment, health care payment and poverty, national and regional patterns of catastrophic health spending, determinants of catastrophic health spending, Drivers of health care expenditure, health financing in India, Equity in health care finances, Willingness to pay for health care, User charges as determinant of health financing, Performance based financing

IV. Health Insurance

Health care system, a model of health care system, defining health insurance, need for health insurance, type of health insurance, demand for private health services, factors affecting the quantity demanded of health insurances, moral hazards, deductibles, co-insurance, managed care, adverse selection, loading fees, employed based insurance, reimbursement, selection effect, intermediary agent, regulation of health insurance, Need for Government intervention, Trends of health insurance, Coverage of health insurance in India, PM-JAY, coverage ad effectiveness

V. **Measuring Health Inequalities**

Measurement of health inequality: A Prelude

Why measure health inequality; Health equity and inequality: Concept and definitions; Understanding of the concepts such as need, access and utilisation; cardinal and ordinal health variables

Black Report and Beyond

Historical Background of Black Report, Explanation for social class differences, major empirical theme since Black report

Measures of health inequality:

Measures of health inequality: Index based approach; Axiomatic approach to measurement; Individual-mean and inter-individual comparison; WHO Index, Coefficient of Variation, Generalised Entropy Index, Lorenz Curve and Gini Coefficient

Measuring socioeconomic rank related health inequality

Slope index of inequality; Relative index of inequality; Concentration curve and concentration index: various ways of computing; Standardization; Inequality aversion; Normalised and Generalised concentration index; Corrected concentration index

Measuring inequality in healthcare utilisation

Horizontal inequality; Vertical inequality; Regression based approach; Measurement of horizontal inequalities; Group inequality, common measures, Gini type index

V. **Medical Care, Production and Cost**

The Short-Run Production Function of the Medical Firm, Total Product, Marginal Product and Average Product Curve, Law of diminishing marginal productivity, The importance of costing in Health Economics, Short-run cost theory of medical firm, short run cost curves, Cost analysis, Implicit and explicit cost, , factor affecting short-run cost curves, cost minimization, constraints in measuring health cost

VI. **Economic Evaluation**

What is economic evaluation? Cost analyses; direct cost, Indirect cost, tangible cost, capital cost, fixed cost, variable cost, Opportunity cost, average cost, marginal cost, Incremental cost, steps in cost analyses: Identification, measurement and valuation, Various types of economic evaluation used in health care: Cost effectiveness analysis (CEA) Cost-Benefit Analysis (CBA), Divergence between social and private costs and benefits in health care, Limitations of economic evaluation, Consumer Impact Assessment.

ESSENTIAL READING LIST

1. Rexford E. Snterre and Stephen P. Neun, Health Economics: Theories, Insights and Industry Studies, Thompson South – Western, 3rd Edition (614, San/Hea, 073226) Note: 4th Edition is out in 2007 (ISBN: 032432068X; ISBN13: 9780324320688)
2. Phelps, Charles E. *Health economics*. Routledge, 2017.
3. Drummond MF, Sculpher MJ, Torrance GW, O'Brien B, Stoddart GL, eds. Methods for economic evaluation of health care programmes, Third Edition, Oxford University Press, 2005.
4. Wagstaff, Adam, Owen O'Donnell, Eddy Van Doorslaer, and Magnus Lindelow. Analyzing health equity using household survey data: a guide to techniques and their implementation. World Bank Publications, 2007.

SUGGESTED READING LIST

1. Arrow, Kenneth J. "Uncertainty and the welfare economics of medical care." In *Uncertainty in economics*, pp. 345-375. Academic Press, 1978.
2. Culyer A J and J P Newhouse, 2000, The state and scope of health economics, Handbook of Health Economics, Volume 1A, Eds. Culyer and Newhouse, Elsevier, 2000.
3. Grossman (1982), On the concept of Health capital and Demand for Health, Journal of Political Economy, 80(2)
4. Glied, Sherry, and Peter C. Smith, ' Introduction', in Sherry Glied, and Peter C. Smith (eds), The Oxford Handbook of Health Economics. 2011; online edn, Oxford Academic, 18 Sept. 2012) https://academic.oup.com/edited-volume/28339
5. Gottret, Pablo Enrique, and George Schieber. *Health financing revisited: a practitioner's guide*. World Bank Publications, 2006.
6. Macintyre S (1997). The Black Report and Beyond-What are the issues, Social Science, Medicine, 44(6):723-745
7. Pauly, Mark V. "The economics of moral hazard: comment." *The American economic review* 58, no. 3 (1968): 531-537.
8. Victoria Y Fan and William D. Savedoff (2014), "Health Financing transition: A conceptual framework and empirical evidences, *Social Science Medicine*, 105 (2014):112-121
9. Wagstaff A, P. Paci and E van Doorslaer (1991), On the measurement of inequalities in health, *Social Science and Medicine* 33(5), 545-557
10. Xu K (2005))Distribution of health payments and catastrophic expenditures Methodology World . .Health Organization

MSD-E4.3	DEMOGRAPHIC MODELS AND INDIRECT ESTIMATIONS

The objectives of learning the course is to acquaint students to understand demographic models, indirect estimations and carry out population projections independently and apply them in other social sector projections.

I. Concepts of Demographic Models:

Stable population; Generalized Population; Momentum of Population Growth; Concept of Multiregional Model; and Micro Model such as Birth Interval, Waiting Time (Birth Distribution etc, Estimation of fecundability?)

II. Indirect methods for estimating fertility:

Needs for Indirect methods; Concept of Reverse Survival Method, Robust Method and method based on Generalized Population Model; Rele's Method; Concept of P/F ratio method and its modification [Hypothetical Cohort methods]

III. Indirect Method of Estimating Mortality:

1. Indirect Methods of Estimating Infant and Child Mortality

(a) Basic concepts, fundamental assumptions and underlying principles to the technique proposed by Brass based on retrospective data on children ever-born and surviving mothers classified by current age of mother; (b) Modifications proposed by Sullivan and subsequently by Trussell over Brass method; and (c) the UN revised and extended version of Trussell's method.

2. Some Methods of Estimating Adult (including Maternal Mortality) and Old Age Mortality

(i) Some methods of estimating adult mortality using successive census age-distributions; (ii) Methods of estimating life expectancies at older ages; and (iii) Estimation of maternal mortality through sisterhood method.

3. Some Indirect Methods for Estimating Death Registration Completeness for Countries Having Limited and Defective Vital Registration Data

An overview of some selected methods of estimating completeness of death registration, starting from Brass growth balance method and its subsequent development.

VII. Lab Practice in MORTPAK

1. Bennett, N.G., and S. Horiuchi (1981): "Estimating completeness of death registration in a closed population", Population Index, 47(2):207-221.

2. Bennett, Nail. G., and Shiro Horiuchi (1984): "Mortality estimation from registered deaths in less developed countries", Demography, 21(2):217-233.

3. Bhat P.N.M, (2002): General growth balance method: A reformulation for population open to migration, Population Studies, 56 (2002), 23-34, Printed in Great Britain.

4. Bhat P.N.M., (2002): Completeness of India's Sample Registration System: An assessment using the general growth balance method, Population Studies, 56 (2002), 119-134, Printed in Great Britain.

5. Coale, A.J., (1981): "Robust estimation of Fertility by the Use of Model Stable Population", Asian and Pacific Census Forum, Vol.8 No.2. East-West Centre, Honolulu, Hawaii.

6. EL. Badry, M.A., (1961): “Failure of Enumerators to make Entries of Zero”, Errors in Recording Childless Cases in Population Censuses, Journal of American Statistical Association Vol. 56.

7. Government of India (2006): Population Projections for India and States, 2001- 2026. New Delhi: Office of the Registrar General.

8. Hill, Kenneth (1987): “Estimating Census and Death Registration Completeness”, Asia and Pacific Population Forum, 1(3): 8-13 &23-24.

9. Horiuchi, S. and A. J. Coale (1982):“A Simple Equation for Estimating the Expectation of Life at Old Ages, Population Studies”, Vol. 36, pp.317-326.

10. Jacob S. Siegel and David a. Swanson (2004): The Methods and Materials of Demography, Second Edition, Chapters 1, 2, 3, 7, 9,10, Elsevier Science, USA.

11. John Weeks (2005): Population: An Introduction to Concepts and Issues, Wordsworth Learning. Singapore 9th edition.

12. Keyfitz, Nathan (1977): Introduction to the Mathematics of Population with Revision, AddisonWesley Publishing Company, Inc., Massachusetts.

13. KIm, Young J., Schoen, R. & Sarma, P.S.(1991) : Momentum and The Growth-Free Segment of Population, Demography, Vol.28, No.1 pp. 159-173.

14. Lahiri, Subrata (1990): Some New Approaches to the Estimation of Life Expectancies at Older Ages, In Dynamics of Population and Family Welfare, 1989, (eds. by Srinivasan and K.B. Pathak), pp.315- 341.

15. Lahiri, Subrata, and Lysander Menezes (2004): “Estimation of adult mortality from two enumerations of a destabilized population subject to response biases in age-reporting”, In Population, Health and Development in India: Changing Perspectives, (Eds. by T. K. Roy, M. Guruswamy, and P. Arokiasamy), Rawat Publications, Jaipur: 2004, pp.101-136.

16. Lahiri, Subrata, Arni S. R. Srinivasa Rao, and S. Srinivasan (2005): Role of Age-specific Growth Rates on Population Ageing in Some Developed and Developing Countries – A Comparative Study, Demography-India, 34(1): 63-83.

17. Martin, Linda G. (1980): “A Modification for use in Destabilized Population Brass's Technique for Estimating Completeness of Death Registration”, Population Studies, 3(1):39-51.

18. Mishra, B.D. (1981). Introduction to Study of Population. South Asian Publishers. Chapters 4 & 7.

19. Mitra, S., 1984, “Estimating the Expectation of Life at Old Ages”, Population Studies, Vol. 38, pp. 313-319.

21. Pathak, K.B. and F. Ram (1998): Techniques of Demographic Analysis, Himalaya Publishing House, Second Edition, Mumbai.

22. Potter, R.G. and Kulkarni, P.M. (1977) : Population Momentum : A WiderDefination, Popluation Studies Vol. 40 pp. 555-56.

23. Preston, S.H., and A.J. Coale (1982): “Age structure, growth, attrition, and accession: A new synthesis, Population Index”, 48(2): 217-259.

24. Preston, S.H.; Himes, Christine and Mitchell, Eggers (1989): “Demographic Conditions Responsible for Population Aging”, Demography, 26 (4): 691-704.

25. Preston, Samuel H. Patrick, Heuveline and Michel Guillot, 2003, Demography: Measuring and Modeling Population Processes, Blackwell Publishers, 2001 (First Indian Reprint 2003).

26. Preston, Samuel H., and Subrata Lahiri (1991): “A Short-cut Method for Estimating Death Registration Completeness in Destabilized Populations”, Mathematical Population Studies, 3(1):39- 51.

27. Rele, J. R. (1967): "Fertility Analysis Through extension of Stable Population Concepts", Population Monograph Series No.2, University of Berkeley.

28. Rele, J. R., (1987), "Fertility Levels and Trends in India, 1951-81", Population and Development Review Vol. 13 (2). Academic Press, New York.

29. Schoen, R. and Kim Young J. (1991) : "Momentum Towards Stability as a Fundamental Principle of Population Dynamics" Demography, Vol.28 No.3, pp.455-466.

30. Seigel Jacob S. and David A. Swanson (eds.) (2004): The Methods and Materials of Demography. 2nd Edition, New York: Elsevier Academic Press. Chapters 20 & 21.

MSD-E5.1	**Population Ageing and Generational Analysis**

Course Outcomes:

CO1: Learn concepts and theoretical framework relating to demography of ageing, and its health and societal interface.

CO2: Develop skills to analyze trends, determinants and consequences of population ageing.

CO3: Familiarize with generational analysis

Unit I: Demography of ageing

A. Concepts and measures of population ageing; components of population ageing; Inter-relationship between population ageing, fertility, mortality and migration; populationageing and momentum of population growth, age structure transition and ageing, and declining population.

B. Population ageing trends, patterns and determinants in India; state variations; future scenario of population ageing in India and states.

Unit II: Life course perspective and social dynamics of ageing

A. Life course perspective of population ageing; Age and Ageing, Ageism; Social Status and Roles of Elderly, Family Structure, Intergenerational relations, Kinship and family support, Social Security; Social network- Frameworks (Berkman and others) and measurement.

B. Living Arrangements of Elderly, Old Age Homes, Social Networks, and Contribution of elderly: "Feminization" of Ageing, Dependency, Gender Dimensions and Discrimination, Widows, Elder abuse, Social and legal Vulnerability.

C. Generational analysis

Unit III: Ageing and health

A. Ageing and Functional Health: Ageing and disabilities; trends and prevalence; Wellbeing and Life satisfaction.

B. Ageing and mental health problems; cognition, memory loss, dementia and depression;Alzheimer's and Parkinson.

C. Ageing and health risk factors: nutrition, diet and food practices; health risk behaviour-tobacco, alcohol; physical activities

Unit IV: Ageing policies and programmes

A. Social and Economic Support Policies and Programmes for the Elderly-Retirement, Pensions and Social Care Policies in developed and developing countries. Social security and welfare policies and programmes for elderly in India. National Programmes for HealthCare of Elderly (NPHCE); National Policy for Senior Citizens

B. Worldwide Longitudinal Ageing Studies: LASI, SAGE, SHARE, HRS, CHARLS, JSTAR, etc.

Essential Reading List

1. Chakraborti, Rajagopal Dhar (2004), The Greying of India: Population Ageing in the Context of Asia, SAGE Publications Private Limited, New Delhi.
2. UNFPA, 2001, Population Ageing and Development: Social, Health and Gender Issues, United Nations, Malta.
3. UNFPA (2011), Report on the status of elderly in select states of India, UNFPA, India.

Suggested Reading List

1. World Health Organization (2015), *WHO Report on Ageing and Health*, WHO,Geneva.
2. United Nations (2001): *Living Arrangements of Older Persons: Critical Issues and Policy Responses*. Population Division, Department of Economic and Social Affairs,Special Issue Nos. 42/43, 2001, New York.
3. Sandra Gruescu, (2006), *Population ageing and economic growth.* Physica-Verlag.
4. M. Alam (2004). Ageing, old age income security and reforms: An exploration ofIndian situation. *Economic and Political Weekly*, 39(33): 3731-3740.
5. Berman, Lisa (2000) "Social Support, Social Networks, Social Cohesion and Health" *Social Work in Health Care* http://dx.doi.org/10.1300/J010v31n02_02.
6. Pool, Ian, Laura R. Wong and Eric Vilquin (ed) (2006), *Age-structural transitions: challengesfor development*. Paris: CIRCRED.

MSD-E5.2	Population, Environment and Sustainable Development

Course Outcomes:

CO1: Learn the concept of sustainable development and its challenges.
CO2: Learn quantitative and qualitative methods in environmental health analysis.
CO3: Comprehend the role of the environment in development modeling.

Unit I: Sustainable development: Conceptual and contemporary issues

Sustainable development; Meaning, Concepts, and Definitions; Inter-linkages between ecology and development; Brundtland Report on Environment and Development; SDG goals, progress; Pillars of SDG; Environmental Kuznetz model, Living Planet Index, ecological footprint;

Approaches to environment; Gandhian, Socialist, Neo-classical approach; Environment and development challenges: Water, energy, health and disease, nutrition, education, energy, food, species, climate;

Trends of global warming and climate change; drivers of global warming and Global Warming Potential (GWP) & climate change; impact of climate change on atmosphere, weather patterns, sea level rise, agricultural productivity and biological responses, CO2 fertilization and agriculture; impact on the economy and spread of human diseases; the challenges for International Environmental Governance.

Unit II: Environmental challenges in India

Calamities and the measurements; urban challenges; environmental health hazards; air Pollution and health- estimate, data sources, Indian standards, geospatial modeling;

Water resources and condition of surface and ground water resources; water quality standards in India; role of state in water resources management, water and health;

Regional Development in India; Women and Environment; Green Movements in India; Solid Waste Management; Success models of efficient environmental management;

Unit III: Environmental resilience, adaptive capacity, and vulnerability (RACV)

Meaning and measurements of vulnerability and resilience, concept and processes of adaptive capacity; indicators and modeling; qualitative methods to measure RACV; Case studies and practical exercises.

Essential Reading List

1. The Economics of Climate Change: The Stern Review (2014) Cambridge University Press
2. UN Climate reports https://www.un.org/en/climatechange/reports
3. Bründtland, G.H. (1987). Our Common Future: The World Commission on Environment and Development, Oxford, Oxford University Press.
4. Psychology and Climate Change (2018) Human Perceptions, Impacts, and

Responses, 2018

Suggested reading list

1. Hardin, Garrett.(1968): "The Tragedy of the Commons." *Science*. Vol. 162, No. 13, reprinted in Rex R. Campbell and Jerry L. Wade, (Eds), *Society and Environment: The Coming Collision.* Allyn and Bacon, Inc: Boston, MA, pp. 1243-1248.
2. Lutz, Wolfgang, A.Prskawetz and W.C.Sanderson (eds.) (2002). *Population and Environment: Methods of Analysis.* Supplement to Population and Development Review. New York, Population Council.
3. Simon, Julian L. (1996). *Population Matters: People, Resources, Environment, and Immigration*. Transaction Publishers: New Brunswick, NJ.
4. Hanley, N., Shogren, J. F., & White, B. 2007. Environmental Economics: In Theory and Practice. Palgrave Macmillan
5. Bongaarts, John. (1992). Population growth and global warming. *Population and Development Review, 18: 299-319.*

MSD-E5.3	GENDER, HEALTH AND DEVELOPMENT

Course Outcomes:

CO1: To sensitize students on gendered perspectives in reading health and development outcome

CO2: To gain an understanding of theoretical and conceptual issues involving gender in examiningdevelopment at large

CO3: To acquaint students with varied gendered frameworks and relevant analytical tools towards genderedinspection

CO4: To offer skills of adopting a gendered outlook in introspecting health and development.

Introduction

The purpose of this section is to explain the basic concepts of three major components of this course namely gender, health and development.

The Concept of gender, Evolution of gender in historical perspective

Patriarchy, Kinship Structure and gender roles, Feminist theories, Gender stratification in traditional and modern societies, Gender Analysis Tools, Gender Sensitive Indicators and Gender budgeting and auditing

Concept of health, Evolution of the concept of Reproductive Health, life cycle approach to RH and recommendations from ICPD

Changing concept of development, Indicators of development, gender adjusted HDI

Gender and Health

This section presents the situation analysis regarding sex differentials in different aspects of health and highlights some special issues of women and men's health.

Situation analysis of sex differentials in morbidity and mortality

Major morbidity and mortality burden in the developing world with major focus on India- sex ratio of births, major health problems experienced by women and men, reproductive health of women and men in developing world, differentials in use of male and female methods of contraception
Health infra-structure and health care providersNutritional status,
susceptibility to infections
Accidents and other risk factor and health seeking behavior
Health and Nutrition issues of adolescent of boys and girls , abuse and maltreatment, Puberty, Sexual Debut, Adolescent Pregnancy, Abortion, women and family planning programs, Contraceptive Technology
Major risk factors of men's health: masculinity, alcoholism, tobacco and drug consumption, accident
Gender and Sexuality: Sexual health of men and women, gender dimension of HIV /AIDS. Genderand Infertility

Gender and Development

The purpose of this section is to understand the sex differentials in health in terms of socio- economic and cultural context of gender and to study the gender dimensions of development.
Understanding social structures- role of caste, class, ethnicity and religion and gender in healthinequalities and health outcomes
Gender dimension of social development, status and role of men and women in household andcommunity, culture, marriage customs, dowry and bride price practices, age at marriage
Gender differentials in household headship and role in decision making

Gender differences in access to knowledge-, education, exposure to media and freedom of movements
Gender based violence- Domestic and community violence and gender, Legal aspects of domesticviolence and rape
Women's role in community life and involvement in politics-as voter, political worker and leader,women in Panchayati Raj Institutions and self-help groups
Media representation of men and women

Gender dimension of economic development: women's access to economic resources, entitlements, land ownership, inheritance laws, access to credit, measurements of women's work,profiling women's work, informal sector involvement, working condition, maternity benefits, wage differentials, gender and poverty
Globalization, changing pattern of economic activity, issues of marginalization and vulnerabilityalong with agency, negotiation and spaces of power, Gender Divisions in Urban Labor Markets, Gender and Migration
Housing, Household environment and its differential impact on men and women's life
Environmental degradation, changes in climate, water table and land use and their differentialimpact on men and women

Gender mainstreaming in health and development programs

The purpose of this section is to understand the concept of mainstreaming gender in developmentand to review the measures taken for eliminating undesirable impact of gender inequalities and to bring women in the main stream of development
The concept of Gender Mainstreaming
Historic overview of Gender Mainstreaming- Women in development (WID)concept and criticismby feminist; shift to Gender and Development (GAD), Gender Mainstreaming and the MillenniumDevelopment Goals (MDGs)
The rights approach to Health, sexual and reproductive rights, violence, human rights and health Paradigm shift from the Target Based Supply Driven Fertility influencing programs to RHApproach.
Legal aspects – laws regarding marriage, dowry, domestic violence, rape PNDT act , property inheritance, maternity and other benefits of working women, sexual harassments at workplace, reservations in political institutions and
Gender mainstreaming in various health and development sectors-
e.g. Agriculture, Health, Education, gender in work place (Public & private) etc.Advocating for Gender equality
Gender responsive policy making and planning of health and development programs.

Section 5: Some case studies of Gender analysis of health and development programs, budgeting and auditing

This section aims to give necessary skills and tools to undertake the gender analysis of health anddevelopment policies and programs and to help them to develop gender sensitive indicators and measures

Essential Readings:

1. Basu, Alaka M., (1992): *Culture, The Status of Women and Demographic Behaviour*, OxfordUniversity, New York.
2. Bhasin K. 1993. *What is patriarchy?,* Kali for Women Publishers, New Delhi.
3. Bhasin K. (2000). *Understanding Gender*, Kali for Women Publishers, New Delhi.
4. Dyson, Tim and Mick Moore, (1983). "On Kinship structure, female autonomy, and demographic behaviour in India", *Population and Development Review* vol. 9(1), pp. 35-60.
5. Ellsberg Mary and Heise Lori L. (2005) *Researching violence against women: A practicalguide for researchers and activists*. WHO and Path, Washington D.C.

6. Folbre, Nancy. (1992). Improper arts: Sex in classical political economy. *Population andDevelopment Review*. 18(1): 105-112.
7. Gita Sen, Adreinne Germain and Lincoln C. Chen, (Eds.), (1994): *Population Policies Reconsidered: Health and Empowerment and Rights*, Harvard University Press, Harvard.
8. Jeffery Patricia and R. Jeffery. 1997. *Population Gender and Politics: Demographic changein rural north India.* Cambridge University, Cambridge.
9. Miller, Barbara, D.(ed) (1993) *Sex and Gender Hierarchies*, Cambridge University Press, NewYork.
10. Hess, B.B. and M.M. Ferree. (1987). *Analyzing Gender: A Handbook of Social ScienceResearch*. Sage Publication, London.
11. United Nation. 2001. *Population, Gender and Development: A Concise Report*. UN, Economicand Social Affairs (Dept. of), New York
12. World Health Organization. (1998). *Gender and Health. Technical paper* WHO/ FRH/WHD/98. (Website: www.who.int)
13. World Bank. (1991). *Gender and Poverty in India*. World Bank, Washington.
14. World Health Organization *(2003): Comparative Evaluation of Indicators for Gender Equityand Health*, Women and Health Programme, Centre for Health Development, Kobe, Japan.
15. William Joan. 1989. Deconstructing Gender, 87 Michigan L Rev. 797. *Law Journal Article*

Suggested Readings:

1. Agnes, Flavia. (2000). Law and gender inequalities: the policies of women's right in India. Oxford, NewDelhi.
2. Anker, R.(1997). *Gender and Jobs: Sex Segregation of Occupations in the World*, ILO, Geneva.
3. Balk, Deborah, 1997): "*Defying Gender Norms* in Rural Bangladesh: A Socio demographic Analysis".
   Population Studies Vol.51, pp. 153-172.
4. Bandhopadhyay, D. 2000. Gender and governance in India. *Economic and Political Weekly*. 35(3):2696-269xxx).
5. Basu, Alaka Malwade. 2000. Gender in population research: Confusing implications for health policy.
   Population Studies. 54: 19-22.
6. Das Gupta, Monica, 1987. Selective discrimination against female children in rural Punjab, India.
   Population and Development Review, 13(1): 77-100.
7. Doyal L.(1995) What Makes Women Sick: Gender and the Political Economy of Health. London,Macmillan.
8. Dreze, Jean and Sen Amartya, (1995): *India: Economic and Social Opportunity*, Oxford UniversityPress, New York.
9. Harriet B. Presser, (1997): Demography, Feminism and the Science-policy Nexus, *Population andDevelopment Review* Vol. 23(2), pp. 295-331.
10. Jeffery, Roger and Basu, Alka M. (Eds.), (1996): Girls Schooling, Women's Autonomy and Fertility Changes in South Asia, Sage Publications, New Delhi.

11. Jejeebhoy S. 1996. Women's Education, Autonomy and Reproductive Behavior: Assessing what we have learned. East West Centre, Hawaii.
12. Reeves Hazel and Baden Sally (2000): Gender and Development: Concepts and Definitions, Report No. 55, Bridge (development- gender) Institute of Development Studies, University of Sussex, Brighton BN1 9RE, UK.
13. Sonya, Andermahr, Lovell Terry and Wolkowitz, Carol, (1997): A Glossary of Feminist Theory, Arnold-Hodder Headline Group, London.
14. Sopher, David, (1980). An Exploration of India: Geographical Perspective on Society and Culture, Cornell University New York

MSD-C16	APPLIED MULTIVARIATE ANALYSIS

I. Review of Multiple Linear Regression Analysis and its Assumptions

II. Advanced Multivariate Techniques

- Simultaneous equation models- the identification problem. Methods of estimation-the instrumental variable method and two-stage-least squares method. Diagnostic checking and model selection
- Generalized linear models: A general model for the response probability, the logit, the probit and the complementary log –log model, choice of link function, Estimation of the generalized model. Latent variable representation of a generalized linear model.
- Revision and extended to binary outcome Structure Equation Modelling, Structural Approach to evaluate the policies/programs, IV-method, structural equation modeling (with an application of latent class models to methodological studies of measurement error),
- Multilevel modelling: A multilevel model for group effects, estimating group effects, random vs. fixed effects, random intercept model
- Generalized linear random intercept model, random intercept logit model, a random slope logit model
- Multilevel and marginal modeling techniques for clustered or longitudinal data (with applications to methodological studies of interviewer effects and modeling trends in the NFHS/LASI survey), two-level random intercept model,
- Concept of Bayes theorem and development of regression techniques based on Bayes concept and its application
- Computer Applications using Stata and MLwiN softwares

Readings:

1. "Applied Multivariate Statistical Analysis" by Richard A. Johnson and Dean W. Wichern (8th edition, 2020) -
2. "Multivariate Statistical Methods: A Primer" by Bryan F. J. Manly (4th edition, 2016)
3. "Multivariate Data Analysis" by Hair, Black, Babin, and Anderson (8th edition, 2019)
4. "Applied Multivariate Techniques" by Subhash Sharma (2nd edition, 2018)
5. "Multivariate Analysis: Methods and Applications" by Alvin C. Rencher (2nd edition, 2003)
6. Rencher, A. C. (2015). Methods of multivariate analysis (2nd ed.). John Wiley & Sons

MSD-C17	PROJECTIONS AND FORECASTING

Objective: The objectives of learning the course is to acquaint students to carry out projections, and forecast independently and apply them with real data.

Course Outcome: On successful completion of this course, the students will be able to

1. Demonstrate the concepts of time series analysis, projection and forecast
2. Understand demographic, mathematical and statistical methods of projections
3. Forecasts with valid conclusions based on appropriate time series data.

I Time series analysis: significance of time series analysis, **N**ature of time series data, measures of dependence, assumption, and component (stationary non-stationary), vector-valued and multidimensional series, moving average, smoothing in the time series context, autoregressive model, ARMA, ARIMA, application in forecast

II. Concept of Projections and forecast: basic concepts and need for projections, forecast, time series analysis, different approaches of projections and forecast: mathematical, time series, regression based, simulation, period vs cohort, building scenarios, expert opinion,

III. Population Estimates and Projections

Concepts of population projections; population estimates, forecasts and projections, uses of population projections.

Methods of interpolation; extrapolation using linear, exponential, polynomial, logistics, Gompertz curves and growth rate models.

Cohort component method: basic methodology; projection of mortality, fertility and migration components; population projections of United Nations, World Bank and Expert Committees of Government of India; accuracy of population projections. Methods of rural-urban and sub-national population projections.

IV. Mortality Forecasts: Lee-carter model, ARIMA model, cause specific mortality

V. Methods of socio-economic projections: labour force projections, school-enrolment, health personnel and households. Multi-state projections and forecasting, Age-Period-Cohort methods

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Reading List

1. Box, G., Jenkins, G.M. Reinsel, G.C. and Ljung, G. (2016): Time Series Analysis: Forecasting and Control. Fifth Ed., Wiley.
2. Montgomery, D.C., Jennings, C. and Kulahci, M. (2016): Introduction to Time Series Analysis and Forecasting. Second Ed., Wiley.
3. Shumway, R.H. and Stoffer, D.S. (2017): Time Series Analysis and Its Applications: With R Examples. Fourth Edition.Springer.
4. Navaneetham Kannan and George Groenewold, (1998): The Projection of Populations: Data Appraisal, Basic Methods and Applications, Population and Sustainable Development Teaching Texts, Thiruvananthapuram: Centre for Development Studies.
5. Smith Stanley K., Jeff Tayman, and David A. Swanson, (2001): State and Local Population Projections: Methodology and Analysis. New York: Kulwer Academic/Plenum Publishers.

MSD-E6.1	SPATIAL ANALYTICS

Course Outcomes:

CO1: Understanding the concept of space and develop spatial dynamics in demographic process.
CO2: Learning visualisation tools of demographic data and draw inferences.
CO3: Learning different Geo-Spatial software to facilitate spatial analytical methods in demographic research.
CO4: Learning Geographic Information System (GIS), spatial pattern analysis and spatial statistical techniquesto explain a specific spatial pattern.

I. Concepts and Theories

Demography as a spatial science; difference between spatial demography and population geography; Spatial pattern and spatial process; location, distance and area; Distance and decay relationship and spatial hierarchy; space, place and region; Type of spaces- concrete and abstract space; absolute, relative and relational spaces.

Understanding demographic process by geographical scale; nature of disaggregated data- Census and secondary sources; Linking micro and macro demography in a spatial frame.

Application of spatial frameworks to demographic process; Space, culture and fertility; Spatial pattern of mortality and diseases; Distance as factor in access to health care and health planning; Migration and distance- gravity model; space, culture and migration; urban sprawl and sub-urbanization.

II. Statistical and Geospatial Data and Software

Spatial Concepts and Cartography: Spatial parameters: Site and location; Scale; Plane and spherical coordinate, Map Projection-UTM, Types of maps: cadastral, toposheet, thematic, digital; Representation of spatial and non-spatial data; **Introduction to geospatial software: GIS**: discrete data: point, and polygon data,
Raster and vector data, layouts preparation. Geocoding and basics of digitization in ArcGIS
Introduction to Geoda: ESDA in (Exploratory Spatial Data Analysi); Local Indicators of Spatial Association (LISA)
Statistical Concepts: Bar diagram, Frequency polygon, Frequency curve; Test of significance, confidence intervals, Univariate and Multivariate Statistics: Correlation and Regression, Matrix algebra; Auto-correlation; kriging, Moran's I index
Introduction to Statistical software: SPSS, STATA, R

III. GIS and Spatial Analysis of demographic data

Representation of statistical data and automated cartography (Lab based exercises):

a) Population distribution map of India using dot and sphere/circle, cubes, combined; Cartograms
b) Density map by Choropleth and population density gradient by Isopleth;
c) Fertility, mortality and natural growth of population by Polygraph.

d) Measurement of population concentration by cumulative curve.
e) Migration flow by Carogram

Concept and application Models:

a) Spatial Lag and Error Regression Modeling;
b) Multilevel modeling (hierarchical linear modeling);
c) Geographically Weighted Regression;
d) Spatial Pattern Analysis;
e) Urban and city level projection

Reading List

1. Anselin, L. (2005). Exploring Spatial Data with GeoDa: A Wookbook. UC Santa Barbara, CA: Center for Spatially Integrated Social Science. available on http://geodacenter.asu.edu/.
2. Bailey, T. and Gatrell, A. C. (19l95): Interactive Spatial Data Analysis. Harlow, Longman.
3. Bonham, Carter G.F. (1995): Information Systems for Geoscientists–Modelling with GIS. Pergamon, Oxford.
4. Chen, X., Orum A.M., and Paulsen K.E. (2013). Introduction to Cities: How Place and Space shape Human Experience. West Sussex, Willey-Blackwell.
5. Dorling, D. and Fairborn, D. (1997): Mapping. Ways of Representing the World. Longman, Harlow.
6. Griffith, D. A. and Amehein (1997): Multivariate Statistical Analysis for Geographers. Englewood Cliffs, New Jersey, Prentice Hall.
7. Kurland K. S., Gorr W. L. (2007). GIS Tutorial for Health. Redlands, CA, ESRI Press.
8. Lo, C.P. and Yeung, A. K. W. (2002): Concepts and Techniques of Geographic Information Systems. New Delhi, Prentice Hall of India.
9. Robinson, A. H. H., Sale R., Morrison J. and Muehrcke, P. C (1984) Elements of Cartography. New York, John Wiley and Sons.
10. Chang, K. (2008). Introduction to Geographic Information Systems. New Delhi, McGraw Hill Education.
11. Shaw, G. and Wheeler, D. (1994). Statistical Techniques in Geographical Analysis. Englewood Cliffs, New Jersey, Prentice Hall.
12. Soja, E. W. (1996). Third space: Journeys to Los Angeles and Other Real-and Imagined Places. Wiley-Blackwell.
13. Barbara E., Ronald R. R., Stephen J. W., Tom P. E. and Sara R. C. (1997). *Geographic Information Systems, Spatial Network Analysis, And Contraceptive Choice*. Demography. 34(2): 171-187.
14. de Castro M. C. (2007). *Spatial Demography: An Opportunity to Improve Policy Making at Diverse Decision Levels.* Population Research and Policy Review 26: 477-509.
15. Paul V. (2007). *Demography as a Spatial Social Science*. Population Research and Policy Review 26: 457-476. (plus Introduction to the special issue of PRPR on Spatial Demography) pp. 455-456).
16. Reibel, Michael, (2007). *Geographic Information Systems and Spatial Data Processing in Demography: A Review.* Population Research and Policy Review 26: 601-608.

MSD-E6.2	BAYESIAN AND SMALL AREA ESTIMATION METHODS

I. Introduction to Bayesian Inference

- Bayesian and Classical Statistics
- Basic principles of Bayesian inference
- Certainty, uncertainty and probability
- Non-informative priors and conjugate priors, Prior and Posterior inference
- Hypothesis testing and credible intervals

II. Introduction to hierarchical models

- Bayesian linear regression model
- Hierarchical and empirical Bayesian models
- MCMC Simulation Methods-Markov chains, M-H algorithm, Gibbs sampling

III. Small Area Estimation

- Introduction to small area estimation
- Small area estimation using hierarchical models
- Synthetic and model-based estimation

IV. Advanced Topics in Bayesian Inference

- Bayesian model averaging
- Bayesian variable selection
- Bayesian nonparametric models

V. Applications of Bayesian and Small Area Estimation

- Bayesian inference for big data
- Machine learning techniques in Bayesian inference
- Bayesian inference for complex models

Readings:

1. Bayesian Data Analysis, Third Edition by Andrew Gelman, John B. Carlin, Hal S. Stern, David B. Dunson, Aki Vehtari, and Donald B. Rubin
2. Small Area Estimation by J.N.K. Rao and Isabel Molina