Master of Science in Biostatistics And Demography

Syllabus

Approved by the Academic Council on 05 July 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

Paper Code	COURSE TITLE SEMESTER I	No. of credits
MBD-F1	Basics of Human Biology	2*
MBD-F2	Social Science Concepts	2*
MBD-C1	Introduction to Demography and History of Population	3
MBD-C2	Basic Demographic Methods	3
MBD-C3	Methods in Biostatistics I	2
MBD-C4	Sample Survey Designs	2
MBD-E1	MBD E-1.1: Data Analysis with R and Python	3
	MBD E-1.2: Data Analysis with STATA	3
	Semester Credits	**13**
	SEMESTER II	
MBD-C5	Basic Concepts and Application of Epidemiology	3
MBD-C6	Infectious Disease Epidemiology	2
MBD-C7	Methods in Biostatistics II	2
MBD-C8	Healthcare Systems and Policies	2
MBD-C9	Demographic Theories and Nuptiality	2
MBD-C10	Advanced Sample Survey Designs and Related Concepts	2
MBD-E2	MBD E-2.1: Introduction to Longitudinal Data Analysis	3
	MBD E-2.2: Introduction to Spatial Statistics	3
MBD-E3	MBD E-3.1: Systematic Review and Application of Meta-Analysis	2
	MBD E-3.2: Large-scale Sample Surveys	2
MBD-V1	Viva-voce	2
	Semester Credits	**20**
	SEMESTER III	
MBD-C11	Research Methods in Epidemiology and Biostatistics	4
MBD-C12	Advanced Demographic Methods	3
MBD-F3	Introduction to Demographic Packages	2*
MBD-C13	Advanced Methods in Biostatistics	2
MBD-E4	MBD E-4.1: Concepts and Measures of Global Health	3
	MBD E-4.2: Big Data using Machine Learning	3
	MBD E-4.3: Health Economics and Financing	3
MBD-E5	MBD E-5.1: Population Ageing and Health Transition	3
	MBD E-5.2: Population, Environment and Sustainable Development	3
	MBD E-5.3: Gender, Health and Development	3
MBD-C14	Survival Analysis	3
	Semester Credits	**18**
	SEMESTER IV	
MBD-C15	Data Management and Analysis in SAS	3
MBD-C16	Demographic Models and Indirect Methods of Estimation	3
MBD-C17	Methods in Clinical Trials	3
MBD-E6	MBD E-6.1: Operations Research in Population and Health	3
	MBD E-6.2: Monitoring and Evaluation in Population and Health	3
	MBD E-6.3: Urbanization, Space and Planning	3
MBD-D	Dissertation	10[$]
MBD-V2	Viva-voce	2
	Semester Credits	**24**
	Total credits	**75**

*Credit not counted for calculating final grade.

$ Evaluation procedure for dissertation (weights): Guide - 0.25, Presentation & Defense – 0.25, Content – 0.50. The grade for ‘presentation & defense must also be given independently by each member, and submitted to the controller of examinations independently. For content, the director may appoint a three-member committee for each dissertation. The three members should independently evaluate the dissertation and independently submit the grades to the controller of examinations.

Foundation Courses

MBD-F1	Basics of Human Biology	30 Hours

Course Outcomes:
CO1: Aware of the basics of human biology.
CO2: Understand the human life cycle and its bearing on health and diseases.
CO3: Familiarity with anatomy and physiology of different organ systems of the human body.
CO4: Acquire basic knowledge about the pathophysiology of human organ systems.

Introduction to human biology; human life cycle; definition & structure of cell, tissue structure & type

Anatomy and physiology of human organ and organ related diseases - Digestive system; respiratory system; cardiovascular system; lymphoid & haemopoietic system (circulatory); nervous & the special senses; muscular and skeletal system; excretory system; urinary system; reproductive system (female and male)

Essential Reading List

1. Guyton Arthur C., 1991, Textbook of Medical Physiology, A Prism Book Pvt. Ltd. Bangalore.
2. Sembulingam K and Prema Sembulingam, 2019, Essentials of Medical Physiology, Jaypee Brothers Medical Publishers New Delhi.

Suggested Reading List

1. Horton Casey, 1994, Atlas of Anatomy, Marshall Cavendish Books, London
2. W. Gordon Sears, Robert S. Winwood and J.L. Smith, 1985, Anatomy and Physiology for Nurses and Students of Human Biology, Education Academic and Medicinal Publishing Division of Hodder and Stoughton, London.
3. Keele, Neil et.al, 1991, Samson Wright's Applied Physiology, Oxford University Press, Delhi.

MBD-F2	Social Science Concepts	30 Hours

Course Outcomes:

CO1: To gain familiarity with basic social science concepts that has bearing on understanding population dynamics.
CO2: Imagine the varied axis of social reality, such as caste, tribe, gender, kinship and marriage, social mobility and religion in terms of its relevance in population studies.
CO3: Viewing population in space and time and read population geography in consideration of man-environment relationship, geographical factors and regional perspective.
CO4: Recognition of interplay between economic development and population changes in an evolving world order.
CO5: To understand the psychological concepts like perception, behaviour, emotion, personality, coping mechanism, communication and their bearing on Population Studies

SOCIOLOGY

1. Sociology: sociology as a social science- its nature, subject matter and scope
2. Relation of sociology with other social sciences, sociological perspective
3. Basic Concepts in sociology
4. The Family:
    a) Sociological Significance of the Family b) Types and functions of Family
    b) Nuclear and joint families
5. Marriage: Different forms of marriage, changing patterns of marriage/mate selection in India
6. Kinship –features of kinship system in India, regional variations
7. Social stratification: Social Class and Caste: Principles of Class and Caste
8. Socialization: agencies of socialization
9. Culture: meaning and characteristics of culture.
10. Society and Culture in India
    a) Aspects of society and culture in India, and its role and importance in Population Studies.
    b) Social Institutions and their role in influencing demographic situation of the Population of India

- Family, Marriage, Kinship and Religion

11. Caste System
    i) Concept and definition of Caste System,
    ii) Changing Caste System in India
12. Social Mobility: vertical and horizontal, intra- and inter-generational mobility
13. Social Change

Definition and Concept of Social Change

14. Process of Social and Cultural Changes in India and their role in influencing demographic behaviour:

a) Sanskritization b) Westernization c) Modernization

GEOGRAPHY

1. 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.
2. 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; Mapsscale, choropleth, isopleths and distribution maps.
3. Physical divisions of India; administrative organization of India. Historic-Cultural regions; Agro-climatic regions; NSS regions.
4. 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.
5. Concept of Social Space; Social Structure and Spatial Structure; Role of time and space in social sciences.

ECONOMICS

1. Introduction:

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

2. 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.

3. Basic Concepts in Macro Economics

Basic Concepts in National Income: Concept of GDP, NDP, GNP, NNP, NI, PCI, PPP, 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.

PSYCHOLOGY

1. Social Psychological Concepts:

The Value of psychology and perspectives in psychology; scientific study of social influences onbehavior and the interaction between individuals and groups; social pressure, leadership

2. Basics of Psychology:

Why Psychology, branches of psychology, methods of research, Psychological wellbeing acrossmajor

stages of the life span. Role of psychology in population studies.

ESSENTIAL READINGS:

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
5. Winston, New York, (1949), Chapters No.1, 3,7,11,15,22,24,25,26.
6. Srinivas M.N**.,** *Social Change in Modern India,* University of California Press, Berkeley, (1966)
7. Sen, A. (2018). Collective Choice and Social Welfare: An Expanded Edition. United Kingdom: Harvard University Press.
8. Haralambos, Michael, *Sociology: Themes and Perspectives,* Oxford University Press, Delhi (1980).
9. Sigmund Freud, The Interpretation of Dreams (1900)
10. Charles M. Duhigg, *The Power of Habit* (2012)
11. Karen Horney, The Neurotic Personality of Our Time (1937)
12. Oliver Burkeman, The Antidote: Happiness for People Who Can't Stand Positive Thinking(2012) .
13. Carl Gustav Jung, Man and His Symbols (1964)
14. Introduction to Psychology 10th Edition James W. Kalat (2013)Abler, R, Adams, J and Gould P., (1971): *Spatial Organization: The Geographer's view of the World,* Prentice Hall, New Jersey.
15. Johnston, R.J., (2004): *Geography and Geographers,* Oxford Unity Press.
16. Richard, Peet**.,** (1998): *Modern Geographic Thought,* Blackwall Publishers
17. Singh, R.L., (1971) *India: A Regional Geography,* National Geographical Society of India, Varanasi.
18. 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
19. Koutsoiannis A, 1979, Modern Microeconomics, London: Macmillan Press Ltd,
20. Lipsey and Chrystal, 2004, Economics, Oxford university Press, Part One, part two and part five
21. Dasgupta AK, Epochs of Economic Theory, OUP, Bombay, Chapters 2, 3, 4, 7 and 8
22. Kuppuswamy B**.,** *Social Change in India,* Konark Publication Pvt. Ltd. Delhi, (1972).
23. Muzumdar, Haridas , *The Grammar of Sociology: Man in Society,* Asia Publishing House, Mumbai (1966).
24. Johnson, Harry M, *Sociology: A Systematic Introduction,* Allied publishers, Bombay (1966).
25. Mc Gee, Reece , *Sociology: An Introduction ,* Holt, Rinehard and Winston, New York (1980).
26. Magill, Frank N (ed.), *International Encyclopedia of Sociology,* Fitzroy Dearborn Publishers, London, (1995).
27. Francis John Monkhouse (1956) *Maps and Diagrams: Their Compilation and Construction*, University of Michigan.
28. JF Friedman (1966) *Regional Development Policy: A Case Study of Venezuela,* Cambridge, Massachusetts : MIT Press, 1966.
29. Samuelson, Paul A. and William D. Nordhaus., "Economics", New York: Tata McGraw Hill, part one, two and five
30. Datt R and Sundaram K.P.M, 2000**,** Indian economy, S. Chand & Company Ltd, Part II.
31. Government of India, Ministry of Finance, Economic Division, Economic Survey

Core Courses

MBD-C1	Introduction to Demography and History of Population	45 Hours

Course Outcomes:

CO1: Learn scope of demography and its relationship with other disciplines.
CO2: Understand the global, regional and national population trends.
CO3: Understand the nature of diversity in the size, distribution, composition, and basic characteristics of population across Indian states.
CO4: Know various sources of demographic data in India, and their limitations.
CO5: Appreciate the historical perspectives on population change.

Unit I: 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; registration of births and deaths act 1969

Unit II: Population History

Global population trends - Historical population trends, world population growth-a brief history, the power of doubling; global variation in population size and growth; past, present and future population trends across the world, continents, and major regions; history of population in India - trends and growth of India's population; concerns of population growth- before and after independence

Unit III: Sources of Demographic Data

Population census across the world; Census taking under British India; Indian census, details of different items on which Indian census collect data, publicationof census data/ reports; Vital registration system; Sample registration system (SRS), survey on causes of death; National Sample Survey Organization's surveys, details of different rounds collecting population and health data; Nationwide sample surveys - National Family Health Survey (NFHS), District Level Household and Facility Survey (DLHS), etc.

Unit IV: Population Theories

Malthus and Marx; optimum population; demographic transition theory

Essential Readings:

1. Bhende, A., (1996): *Principles of Population Studies* (Seventh Edition), Himalaya Publishing House, Bombay.
2. Jacob S. Siegel and David a. Swanson (2004): *The Methods and Materials of Demography,*Second Edition, USA.
3. John Weeks (2005): Population: An Introduction to Concepts and Issues, Wordsworth Learning. Singapore 9th edition.
4. United Nations, (1973): The Determinants and Consequences of Population Trends, Vol. I, Population Studies, No. 50, Chapter VII, New York.

Suggested Reading List

1. Davis, Kingsley (1968). The Population of India and Pakistan, Russell and Russell, New York.
2. Bogue, D. (1969): *Principles of Demography*, John Wiley and Sons, New York.
3. Livi-Bacci, M. (1996): A Concise History of World Population (2nd edition), Oxford.

MBD-C2	Basic Demographic Methods	45 Hours

Course Outcomes:

CO1: Learn basic demographic concepts and measures of fertility, mortality and migration.
CO2: Learn synthetic formulation of survival experience (e.g. life table).
CO3: Understand the need for standardized comparison of demographic measures.
CO4: Learn computation and interpretation of levels and trends of fertility, mortality, and migration

Unit I: 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; cohort measures; birth interval analysis; reproduction measures

Determinants of natural fertility; Davis intermediate variables framework of fertility; Bongaarts proximate determinants

Unit II: 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; standardization: direct and indirect technique of standardization of rates and ratios; 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

Unit III: Migration

Concept and definition of mobility and migration: sources, quality and limitation of data; definition and concept of urban and urbanization

Types and streams of migration; internal migration - trend, patterns, determinants and consequences in developing countries with a special focus on India; international migration - trend, pattern and consequences

Degree of urbanization; 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 return migration;

Essential Reading List

1. 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.
2. Pathak, K.B. and F. Ram, (1998) Techniques of Demographic Analysis, Mumbai:Himalaya Publishing House, Chapter 4, Pp.108-153.
3. United Nations, (1974): *Methods of Measuring Internal Migration,* Manual VI, UN, New York.

Suggested Reading List

1. Preston, Samuel, Patrick Heuveline, and Michel Guillot: Demography – Measuring and Modeling Population Processes, Wiley-Blackwell, 2001.
2. Asha A. Bhende and Tara Kanitkar, (2003), *Principles of Population Studies,* Sixteenth Revised Edition, Himalaya Publishing House, Mumbai.
3. Hinde, Andrew (1998) *Demographic Methods.* London: Arnold.
4. John R. Weeks, (2005), *Population: An Introduction to Concepts and Issues,* Nineth Edition, Wadsworth Publishing Company, Belmont, California.

MBD-C3	Methods in Biostatistics I	30 Hours

Course Outcomes:

CO1: Learn the basic concepts of Biostatistics.
CO2: Understand types of data and summarizing data.
CO3: Understand basic concept of probability and sampling distributions.
CO4: Learn basic concepts of statistical inference.
CO5: Understand statistical methods.

Unit I: Introduction

Definition and objectives of biostatistics

Unit II: Types of data

Categorical data; numerical data; censored data

Unit III: Summarizing data

Tables and graphs; measures of central tendency; measures of dispersion and variability; measures of skewness and kurtosis

Unit IV: Probability concepts and distributions

Random variables; concept of probability; probability distributions; joint, marginal, conditional distributions

Unit V: Sampling distributions

Normal distribution, Chi-square distribution, F- distribution and Student's t distribution; methods for finding estimators - method of moments, maximum likelihood method; properties of estimators- Unbiasedness, Efficiency and consistency.

Unit V: Basic concepts of statistical inference

Using samples to understand populations; standard error; confidence intervals; hypothesis tests, p-value, and statistical power

Unit VI: Goodness of fit and contingency tables

Unit VII: Non-parametric methods

Unit VIII: Statistical methods

Correlation; linear regression; analysis of variance

Essential Reading List

1. Altman D G: Practical Statistics for Medical Research, London: Chapman and Hall,2006.
2. Rosner B: Fundamentals of Biostatistics, ed. 6, 2006.
3. Mood, A.M., Graybill, F.A., and Boes, D.C.: Introduction to the Theory of Statistics, Third edition. McGraw Hill.

Suggested Reading List

1. Zar, C Z: Biostatistical Analysis, 5th Edition, 2015
2. Bonita R, Beaglehole, R, Kjellstrom, T: Basic Epidemiology, 2nd Edition, 2006.

MBD-C4	Sample Survey Designs	30 Hours

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.

Unit I: Introduction and basic concepts

Introduction; need for sample surveys; sample survey versus complete enumeration; population, units and sampling units; sampling design; probability and non-probability sampling; sampling frame; bias and errors in sample surveys

Unit II: Simple random sampling

Description; method of selection; estimation of mean, total, and proportion; sampling variance of mean, total and proportion; determination of sample size

Unit III: Stratified random sampling

Description; estimation of mean, total, and proportions; sampling variance of mean, total, and proportions; allocation and selection of units; advantages of stratification

Unit IV: Systematic sampling

Description; method of selection; circular systematic sampling; advantages and disadvantages of systematic sampling; estimation of sampling variance

Unit V: Cluster sampling

Description; method of selection; estimation of parameters; estimation of sampling variance of parameters

Essential Reading List

1. Cochran, W.G. (1977). Sampling Technique, Third edition. New York: John Wiley& Sons.
2. Kish, L. (1995). Survey Sampling. New York: John Wiley and Sons, INC.
3. Roy, Tarun Kumar, Acharya, Rajib, and Roy, Arun Kumar (2016). Statistical Survey Design and Evaluating Impact. Delhi, India: Cambridge University Press.

Suggested Reading List

1. Lwanga, S.K. and Lemeshow, S. (1991). Sample size determination in healthstudies. Geneva: The World Health Organization.
2. Ladusingh, Laishram (2018). Survey Sampling Methods. Prentice Hall India.

MBD-C5	Basic Concepts and Application of Epidemiology	45 Hours

Course Outcomes:

CO1: Learn the basic concepts of different streams of Epidemiology, measuring the occurrence of disease, and disease risks.

CO2: Understand the study designs widely used in Epidemiology.

CO3: Learn the application of Epidemiology for evaluating health services.

Unit I: Introduction

Definition and objectives of epidemiology; epidemiology and clinical practice; the epidemiologic approach; infectious disease epidemiology, occupational epidemiology, disaster epidemiology

Unit II: Measuring the occurrence of disease

Measures of morbidity - prevalence and incidence rate, association between prevalence and incidence, uses of prevalence and incidence, problems with incidence and prevalence measurements

Unit III: Issues in epidemiology

Association; causation; causal inference; errors and bias; confounding; controlling confounding; interactions; generalizability

Unit IV: Estimating risk

Estimating association – absolute risk, relative risk, odds ratio; estimating potential for prevention – attributable risk; comparison of relative risk and attributable risk; odds ratios for retrospective studies; odds ratios approximating the prospective RR; exact inference for odds ratio analysis of matched case-control data

Unit V: Application of epidemiology to identify the cause of disease

Cohort studies; case-control studies; nested case-control studies; comparing cohort and case-control studies; experimental studies

Unit VI: Application of epidemiology to evaluate health services

Essential Reading List

1. Gordis L: Epidemiology, ed. 3. Philadelphia, 2004.
2. Bonita R, Beaglehole R, Kjellstrom T*:* Basic Epidemiology, ed. 2. World Health Organization, 2006.
3. Dunn G, Everitt B: Clinical Biostatistics: An Introduction to Evidence-based Medicine. Edward Arnold, 1995.

Suggested Reading List

1. Park, K.**:** Park**'**s Textbook of Preventive and Social Medicine. **26**th Edition, M/S Banarsidas Bhanot Publishers, Jabalpur**, 2021.**
2. MacMahon B, Pugh T F: Epidemiology: Principles and Methods. Boston, Little Brown, 1970.

MBD-C6	Infectious Disease Epidemiology	30 Hours

Course Outcomes:

CO1: Learn terms and concepts of infectious disease epidemiology.
CO2: Learn concepts and methods related to modelling of infectious diseases.
CO3: Learn concepts, principles, and uses of surveillance of infectious diseases.
CO4: Familiarity with history and implications of infectious diseases.

Unit I: Introduction and basic concepts

Introduction; basic concepts; epidemiological triad; chain of transmission.

Unit II: Spread of infectious diseases and determinants

Epidemic, endemic and pandemic; disease outbreak; determinants of disease outbreak; herd immunity; incubation period

Unit III: Modelling infectious diseases

Transmission dynamics models; SI, SIS, SIR, and SICR models; Kermack- McKendrick threshold theorem; Kermack- McKendrick threshold theorem epidemiology; basic reproductive number (R_0); what determines R_0; effective reproductive number (R_t); eradication threshold; other considerations while vaccinating; estimating R_0.

Unit IV: Surveillance of infectious diseases

Surveillance of infectious diseases; guiding principles behind surveillance; uses of surveillance; integrated disease surveillance programme in India; outbreak investigation.

Unit V: History, implications and health care responses to a pandemic

Examples of COVID-19, SARS, etc.

Essential Reading List

1. Gordis L: Epidemiology, ed. 3. Philadelphia, 2004.
2. Park, K.: Park's Textbook of Preventive and Social Medicine. 26th Edition, M/S Banarsidas Bhanot Publishers, Jabalpur, 2021.
3. Abubaker, Ibrahim, Helen R Stagg, Ted Cohen, and Laura C Rodrigues: Infectious Disease Epidemiology, Oxford University Press, 2016.

Suggested Reading List

1. Giesecke, Johan: Modern Infectious Disease Epidemiology 3rd Edition, CRC Press, 2017.
2. Kramer, Alexander, Mirjam Kretzschmar, and Klaus Krickeberg: Modern Infectious Disease Epidemiology – Concepts, Methods, Mathematical Models, and Public Health, Springer New York, 2012.
3. Centers for Disease Control and Prevention (CDC). Introduction to Public Health. In: Public Health 101 Series. Atlanta, GA: U.S. Department of Health and Human Services, CDC; 2014.

MBD-C7	Methods in Biostatistics II	30 Hours

Course Outcomes:

CO1: Understand multivariable regression models and related concepts.
CO2: Understand the use and interpretation of outputs of multivariable regression models.
CO3: Understand other multivariate techniques

Unit I: Multivariable regressions

Multiple regressions; partial correlation, relationship among simple, partial and multiple correlation coefficients; issues in multivariable regressions – multicollinearity, interaction, outliers; non-linearity; missing data; R^2 and adjusted R^2; omission of relevant variables and inclusion of irrelevant variables; multivariable regression with dummy explanatory variables; effect modifier

Unit II: Multivariable regression with categorical outcome variables

Binary logistic regression; conditional logistics regression; multinomial logistic regression; probit regression

Unit III: Multivariable regression with ordinal and count outcome variables

Ordinal logistic regression; poisson regression

Essential Reading List

1. Kennedy, Peter (2008). A Guide to Econometrics, 6th Edition. Wiley-Blackwell.
2. Agresti, Alan (2002). Categorical data analysis. New York: Wiley.
3. Cameron, A.C. and Trivedi, P.K. (1998). Regression analysis of count data. Cambridge University Press.

Suggested Reading List

1. Gujarati, DN and Sangeetha (2007). *Basic Econometrics* (Fourth Edition), TataMcGraw Hill, New Delhi.
2. Breslow, N.E. and Day, N.E. (1980). Statistical methods in cancer research. Vol I-the analysis of case-control studies. IARC Scientific Publication No. 32. Lyon: International Agency for Research on Cancer.
3. 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.

MBD-C8	Healthcare Systems and Policies	30 Hours

Course Outcomes:

CO1: Become aware about the basic concepts of health/health services/health care.
CO2: Understand health systems and services.
CO3: Understand health policy and its formulation.
CO4: Understand the regulations in the health sector.

Unit I: Basic Concepts

Concepts of health; public health; community health; preventive and curate health; one health; health promotion; health services; and primary, secondary and tertiary care; health data sources

Unit II: Health System

Goals; boundaries; functions; WHO's health system building blocks - service delivery, health workforce, health Information systems, access to essential medicines, financing and leadership/governance.

Unit III: Health Services

Basic models and functions of health services; international experiences; goals and elements in universal health care (UHC) approach.

Unit IV: Health care system in India

Public sector; private sector; voluntary sector; human resources for health; access to health care; utilization and expenditure on health services; UHC initiatives and challenges ahead; health workforce

Unit V: 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 VI: Health policymaking in India

Health planning in post-Independent India; national health policies; national health policy 2017; current national health programmes.

Unit VII: Regulation in the health sector

Need for regulations; mechanisms for regulations; 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.

Suggested Reading List

1. Government of India. 2017. National Health Policy-2017. New Delhi: Ministry of Health and Family Welfare, Government of India.
2. Balarajan, Yarlini, Selvaraj Selvaraj, and S. V. Subramanian. "Health care and equity in India." The Lancet 377, no. 9764 (2011): 505-515.
3. Gilson, Lucy, and World Health Organization. Health policy and system research: a methodology reader: the abridged version. World Health Organization, 2013.
4. 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.
5. Nandraj, S., Gupta, P., & Randhawa, S. (2021). Regulation of Health Care Delivery in India - A Landscape Study, Health Systems Transformation Platform, New Delhi.

MBD-C9	Demographic Theories and Nuptiality	30 Hours

Course Outcomes:

CO1: Learn fertility theories.
CO2: Learn framework of child survival.
CO3: Learn basic concepts of nuptiality.
CO4: Identify the different sources of data for nuptiality
CO5: Perform nuptiality analysis

Unit I: Fertility theories

Theory of social capillarity; theory of change and response; theory of diffusion and cultural lag; Liebenstein theory; Becker's theory; Easterlin framework of fertility; Caldwell's theory; U. N. threshold hypothesis; reproductive motivations and value of children theories.

Unit II: Mosley & Chen framework of child survival

Unit III: Nuptiality

Introduction, Basic Concepts, Sources of Data and their limitations. Measures of Nuptiality from Registration data.
Analysis of Marital Status Data from Census.
Singulate Mean Age at Marriage (SMAM) - Synthetic Cohort and Decadal Synthetic Cohort Method.
Indices of Nuptiality (Coale's Indices)

Marriage Pattern in India and Selected Countries and related factors.

Marriage squeeze: Concepts and Implications, Concepts of Hypergamy and Hypogamy Gross and Net Nuptiality Tables.
Non-marriage
Multistate approach in Nuptiality analysis. Standard Age Pattern of Marriage – Coale's Model.

Divorce and Widowhood.

i. Definition and basic measures.
ii. Marriage Dissolution Tables and Remarriage Concept
iii. Mean Age at Widowhood/Divorce from Census Returns.

Definition and Measures of Remarriages of Widowed and Divorces

ESSENTIAL READINGS:

1. Siegel, Jacob S., and David A. Swanson (eds.), (2004) *The Methods andMaterials of Demography* (Second edition). San Diego: Elsevier Academic Press.
2. Newell, Colin (1988) *Methods and Models in Demography.* London: Frances Pinter.
3. Asha A. Bhende and Tara Kanitkar, (2003), *Principles of Population Studies,*
4. Sixteenth Revised Edition, Himalaya Publishing House, Mumbai.

5. Pathak, K.B. and F.Ram, (1998) Techniques of Demographic Analysis,Mumbai: Himalaya Publishing House, Chapter 4, Pp.108-153.

SUGGESTED READINGS:

1. Coale Ansley J. and T. James Trussell (1978) *Technical Note: Finding the TwoParameters that Specify a Model Schedule of Marital Fertility. Population Index 44, 2* (1978), pp. 203-213.
2. Mosley, W.H. and Chen, L.C. (1984). *An analytical framework for the study of child survival in developing countries*. Population and Development Review 10: 25-45.
3. Palmore, James A. and Gardner, Robert W. (1983) *Measuring Mortality, Fertility and Natural Increase: a Self-Teaching Guide to Elementary Measures*. Honolulu: East-West Population Institute, East-West Center.
4. Rowland, Donald T. (2006), *Demographic Methods and* Concepts. New York: Oxford University Press.
5. Bogue, Donald J., Eduardo E. Arriaga, and Douglas L. Anderson, eds. (publication editor George W. Rumsey) (1993) *Readings in Population Research Methodology.* Chicago: United Nations Population Fund. Volume 3: FertilityResearch, (All three chapters but selected pages).
6. Pollard, A.H., Yusuf, Farhat and Pollard, G.N. (1990) *Demographic Techniques* (third edition). Sydney: Pergamon Press.

MBD-C10	Advanced Sample Survey Designs and Related Concepts	30 Hours

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

Essential 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.

Suggested Reading List

1. Ladusingh, Laishram (2018). Survey Sampling Methods. Prentice Hall India.
2. Cochran, W.G. (1977). Sampling Technique, Third edition. New York: JohnWiley & Sons.

MBD-C11	Research Methods in Epidemiology and Biostatistics	60 Hours

Course Outcomes:

CO1: Become familiar with the scientific approaches for conducting research.
CO2: Understand qualitative and quantitative methods of data collection.
CO3: Understand qualitative data analysis using packages like Atlas Ti, Nvivo and Dedoose.
CO4: Enhanced skills for writing a proposal and scientific articles.
CO5: Gain experience of field level setting and primary data collection.

Unit I: Philosophy of Research

Unit II: Scientific Methods of Research

Definition of research, assumptions, operations and aims of scientific research; the research process - conceptual, empirical and analytical phases of research

Unit III: Validity and reliability of diagnostic and screening test

Validity of screening test – sensitivity, specificity, positive predictive value and negative predictive value; reliability; relationship between validity and reliability; ROC curve and its applications; overall accuracy

Unit IV: Clinical agreement

Kappa statistics

Unit V: Research Ethics

Ethics of Research; history of ethical guidelines and general principlesinformed consent and human subject protection; ICMR ethical guidelines for biomedical research on human participants; biomedical research on human subjects -regulation, control and safeguards

Unit VI: Quantitative methods of data collection

Questionnaire (mail method, interviews through telephone,internet and computers), interview schedule (face-to-face interviews or personal interviews); questionnaire/interview schedule design and construction - principles of constructing a questionnaire/interview schedule, types of questions, framing of questions, sequencing of sections and questions and interview techniques

Unit VII: Qualitative methods of data collection

Introduction to qualitative research; approaches in qualitative research; participatory rapid techniques – transect walk, social mapping; systematic techniques – free listing, pile sorting, Delphi techniques, projective techniques, mechanical devices (camera, tape recorder, mobile recording), mystery client technique; in-depth techniques – in-depth interviews, focus group discussion, key informant interview, case study, observation

Unit VIII: Data Collection and processing

Unit IX: Analysis of qualitative data using softwares

Nvivo; ATLAS Ti; Dedoose

Unit X: Writing research proposal and report

Purpose of a proposal/report; content of proposal/report; critical review of research report and journal article; introductory section, methodology adopted, development of research tools; protocol preparation; analysis and inferences; summary, conclusions and recommendations; references/bibliography; appendices; footnotes; STROBE checklist

Essential Reading List

1. Given, Lisa M: The SAGE Encyclopedia of Qualitative Research Methods, SAGE Publications Inc., 2008.
2. Dunn G, Everitt B: Clinical Biostatistics: An Introduction to Evidence-based Medicine. Edward Arnold, 1995.
3. Wolf, Christof, Dominique Joye, Tom W Smith, and Yang-chih Fu: The SAGE Handbook of Survey Methodology, SAGE Reference Los Angles, 2016.

Suggested Reading List

1. Schensul, Stephen L, Jean J Schensul, and Margaret D LeCompte: Essential Ethnographic Methods – Observations, Interviews, and Questionnaires, Altamira Press, Walnut Creek, 1999.
2. Indian Council of Medical Research (ICMR): National Ethical Guidelines for Biomedical and Health Research involving Human Participants, ICMR New Delhi, 2017.
3. Creswell, John W: Qualitative inquiry and research design: Choosing among five approaches-2nd ed. Sage Publications, 2007.
4. United Nations: Household Sample Surveys in Developing and Transition Countries, Department of Economics and Social Affairs, United Nations New York, 2005.

MBD-C12	Advanced Demographic Methods	45 Hours

Course Outcomes:

CO1: Measure and analyze the age-sex structure of a population and its determinants and consequences.
CO2: Learn framework of child survival.
CO3: Learn stable population model
CO4: Learn methods used for evaluating and adjusting demographic data.
CO5: Learn methods used for population projections.

Unit I: Age and sex structure and its implications

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; socio-economic implications of age and sex structure

Unit II: Stable Population model

Stable population; conditions producing a stable population; equations characterizing a stable population; relation between intrinsic growth rate and NRR; effects of changes in fertility and mortality on age structure; momentum of population growth

Unit III: Evaluation and adjustment of demographic data

Types of errors - coverage and content errors; sources of errors; post-enumeration surveys, dual record system; techniques of evaluation of age data using Whipple's index, Myer's index, UN Joint score; smoothing of age data

Unit IV: 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 and Gompertz curves; cohort component method - basic methodology; projection of mortality, fertility andmigration components; population projections of United Nations, World Bank and Expert Committees ofGovernment of India; methods of rural-urban and sub-national population projections; methods of related socio-economic projections: labour force, school-enrolment, health personnel and households;

Essential Reading List

1. Preston, S.H., Heuveline, P and Guillot, Michel (2001). Demography: measuring and modelling population processes. Oxford: Blackwell Publishers Ltd.
2. Shryock, H.S. and Siegel, J.S. (1976). The methods and materials of demography.California: Academic Press, Inc.
3. United Nations (1956). Manual III. Methods for population projections by age andsex. New York: United Nations.

Suggested Reading List

1. Moultrie, Tom et al. (2013). Tools of demographic estimation. Paris: IUSSP.
2. Srinivasan, K. (1997). Basic demographic techniques and applications. New Delhi:SAGE.

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

MBD-F3	Introduction to Demographic Packages	30 Hours

Course Outcomes:

CO1: Gain understanding of demographic packages.
CO2: Capable of estimating demographic outcomes using these packages.
CO3: Capable of projecting demographic and health parameters using these packages.

Unit I: Introduction of MORTPAK

File - new, open, close; save input and output; print worksheet; Edit - undo, select, cut, copy, and clear from worksheet, paste to worksheet; view; application; run; chart; window.

Unit II: MORTPAK modules and their application

BENHR; COMPAR; FERTCB; FERTPF; ICM; LIFTB; QFIVE; STABLE; WIDOW.

Unit III: Introduction and application of SPECTRUM

Introduction; DemProj; FamPlan; LiST; AIM; Goals; Resource Needs Module; TIME; Malaria; STI; NCD.

Essential Reading List

1. Futures Institute: SPECTRUM Manual: Spectrum System of Policy Models, Future Institute.
2. United Nations: MORTPAK for Windows. United Nations, 2013.

MBD-C13	Advanced Methods in Biostatistics	30 Hours

Course Outcomes:

CO1: Become aware about the advanced multivariate models.
CO2: Capable of estimating and interpreting advanced multivariate models.
CO3: Capable of estimating and interpreting multilevel models.
CO4: Learn other multivariate techniques

Unit I: Simultaneous equation models

Identification problem; methods of estimation - instrumental variable method and two-stage-least squares method; diagnostic checkingand model selection

Unit II: 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 generalized model; latent variable representation of a generalized linear model

Unit III: Multilevel modelling

A multilevel model for group effects; estimating group effects; random vs. fixed effects; random intercept model; random slope model; generalized linear random intercept model; random intercept logit model; random slope logit model

Unit IV: Other multivariate techniques

Factor analysis; discriminant analysis; cluster analysis; correspondence analysis

Essential Reading List:

1. Snijders, Tom A.B. and Bosker, Roel J., (1999): *Multilevel analysis: An introduction to basic and advanced multilevel modeling.* Sage Publications.
2. McCullagh, P., & Nelder, J.A. (1989). *Generalized linear models.* CRC press.
3. Hair Jr, J.F., Black, W.C., Babin, B.J. and Anderson, Roph E. (2009) Multivariate data analysis 7th Edition. Pearson.

Suggested Reading List

1. Goldstein, H. 2003. Multilevel Statistical Models. Arnold. Some of the contents can be downloaded for from the following link, including updates and corrections: Multilevel Statistical Models (3rd Edition).
2. Gujarati, DN and Sangeetha (2007). Basic Econometrics (Fourth Edition), Tata McGraw Hill, New Delhi.
3. Dobson, AJ & Barnett, A. (2008). An Introduction to Generalized Linear Models. Chapman and Hall.
4. Backhaus, K., Erichson, B., Gensler, S., Weiber, R. and Weiber, T. (2021). Multivariate Analysis: an application-oriented introduction. Springer Gabler Wiesbaden.

MBD- C14	Survival Analysis	45 Hours

Course Outcomes:

CO1: Learn basic premises of survival analysis and its application.

CO2: Learn application of non-parametric methods for estimating survival functions and differentiation of survival curves.

CO3: Learn frequently used regression models of survival analysis.

Unit I: Introduction

Introduction to survival analysis; motivating the need; concepts and definitions; concept of censoring and type of censoring

Unit II: Functions of survival time

Survival function, probability density function, hazard function; relationship between the three types of function; survival curve; estimating medium survival time; estimation of these function in the absence and presence of censoring; application of these functions in survival analysis

Unit III: Survival distributions

Weibull distribution; exponential distribution; lognormal distribution; gamma distribution

Unit IV: Nonparametric methods of estimating survival function

Introduction; Kaplan-Meier estimates; life table estimates; clinical life tables; life table vs. Kaplan-Meier estimates; the Mantel-Haenszel test

Unit V: Comparing survival curves

Generalized Wilcoxon (Breslow, Gehan); Logrank test

Unit VI: Regression methods for survival analysis

Introduction to Cox-proportional hazard models; proportionality assumption in Cox-proportional hazard models; test of proportionality; interpretation of coefficients; application of Cox-proportional hazardmodels in Epidemiology and Public Health; discrete-time survival models; regression models with time dependence; competing risks

Essential Reading List

1. *Altman D G:* Practical Statistics for Medical Research, London: Chapman and Hall, 2006
2. *Lee E T:* Statistical Methods for survival Data Analysis, ed. 2. New York, John Wiley & Sons.

Suggested Reading List

1. *Armitage P, Berry G:* Statistical Methods in Medical Research, ed.4, Wiley Blackwell, 2001.
2. *Choe MK, Retherford RD:* Statistical Models for Causal Analysis, Wiley-Interscience, 1993.

MBD-C15	Data Management and Analysis in SAS	45 Hours

Course Outcomes:
CO1: Learn the functioning of the SAS statistical packages in handling data sets.
CO2: Learn data wrangling in SAS.
CO3: Learn data analysis in SAS.
CO4: Learn the survey data analysis module in SAS.

Unit I: Access and create data structures and generate reports and output
Create temporary and permanent SAS data sets; use a LIBNAME statement to assign a library reference name to a SAS library; access SAS data sets with the SET statement; INFILE Statement & PROC IMPORT to access non-SAS data sources; combine SAS data sets; use informats and formats to correctly read & display data; control observations and variables in a SAS data set by using the WHERE statement & DROP and KEEP statements; generate list reports using the PRINT procedure; generate reports using ODS statements.

Unit II: Manage data
Sort observations in a SAS data set; conditionally execute IF-THEN/ELSE statements; use assignment statements in the DATA to create new variables and assign a new constant value & an expression to a variable; Modify variable attributes using RENAME= options and LENGTH, LABEL and FORMAT statements in the DATA step; Accumulate sub-totals and totals using DATA step statements; use SAS functions to manipulate character data, numeric data, and SAS date values; use SAS functions to convert character data to numeric and vice versa; process data using DO LOOPS; restructure SAS data sets with PROC TRANSPOSE; create macro variables with the %LET statement; use macro variables within SAS programs.

Unit III: Estimation of measures of central tendency and dispersion

Unit IV: Analysis of variance and covariance
One sample tests; two-sample tests; one-way analysis of variance; two- and N- way analysis of variance; analysis of covariance

Unit V: Linear regression analysis and regression diagnostics

Unit VI: Regression models for binary, categorical and ordinal outcomes; conditional logistic regression model

Unit VII: Regression models for survival data analysis
Cox proportional hazard model; test for proportionality assumption; discrete-time survival models

Unit VIII: Event-count models
Poisson regression; generalized linear models

Unit IX: Survey data analysis

Estimation of mean and proportion; estimation of multivariable linear regression and binary and multinomial logistic regression models

Essential Reading List

1. Field, Andy and Miles, Jeremy (2010). *Discovering Statistics using SAS*. SAGE Publishing.
2. Cody R, Smith J (1997). *Applied Statistics & the SAS Programming Language, 4th Edition*. Prentice Hall.

MBD-C16	Demographic Models and Indirect Methods of Estimation	45 Hours

Course Outcomes:

CO1: Learn and appreciate the concept of demographic modelling of events, processes, and outcomes.

CO2: Familiarity with indirect estimation procedures of vital rates towards verifying its robustness with observed survey estimates.

CO3: Learn the limitation in available data and service statistics as regards its completeness, accuracy, and reliability.

Unit I: Concepts of demographic models

Concept of multiregional model; micro models, such as birth interval, waiting time (birth distribution etc, estimation of fecundability)

Unit II: Indirect methods for estimating fertility

Need 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]; own-children method of fertility estimation

Unit III: Indirect method of estimating mortality

Methods for estimating infant and child mortality: basic concepts, fundamental assumptions, and underlying principles to the technique proposed by Brass based on retrospective data on children ever-born andsurviving mothers classified by current age of mother; modifications proposedby Sullivan and subsequently by Trussell for Brass method; the United Nations revised and extended version of Trussell's method

Methods for estimating adult (including maternal mortality) and old–age mortality: Estimating adult mortality using successive census age- distributions; methods for estimating life expectancies at older ages; estimation of maternal mortality through sisterhood method

Unit IV: Assessing completeness of death registration

Methods for estimating death registration completeness for countries having limited and defective vital registration data: Overview of some selected methods of estimating completeness of death registration - Brass growth balance method and its subsequent development

Essential Reading List

1. Preston, Samuel H. Patrick, Heuveline and Michel Guillot, 2003, *Demography: Measuring and Modeling Population Processes*, Blackwell Publishers, 2001 (First Indian Reprint 2003).
2. Pathak, K.B. and F. Ram (1998): *Techniques of Demographic Analysis*, Himalaya Publishing House, Second Edition, Mumbai.
3. United Nations (1983): *Indirect Techniques for Demographic Estimations*, Manual X, Population Studies No.81, Department International Economic and Social Affairs, (ST/ESA/SER.A/81).

Suggested Reading List

1. Moultrie, Tom et al. (2013). Tools of demographic estimation. Paris: IUSSP.
2. 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.
3. 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.
4. Keyfitz, Nathan (1977): *Introduction to the Mathematics of Population with Revision*, Addison-Wesley Publishing Company, Inc., Massachusetts.

MBD-C17	Methods in Clinical Trials	45 Hours

Course Outcomes:

CO1: Learn features and characteristics of clinical trials and its execution.

CO2: Learn varying designs, recruitment of clients, and various stages of clinical trials.

CO3: Learn methods for analyzing clinical trial data.

Unit I: Basic concepts of clinical trials

Basic concepts; definitions; historical perspectives

Unit II: Classification of trials by design and purpose

Phases of clinical trials, concept of randomization, process of randomization, types of blinding

Unit III: Clinical trial designs

Completely randomized design, randomizedblock designs and factorial designs; cross-over designs

Unit IV: Sample size determination

Sample size determination for qualitative and quantitative outcomes, sample size for cluster randomization, sample size for repeated trials

Unit V: Planning and conduct of clinical trials

Protocol development; multicentric trials; deviations from protocol; stopping rules; considerations of adverse effects and non-compliance

Unit VI: Ethical issues

Ethical issues in clinical research; ICMR guidelines on ethical issues in medical research

Unit VII: Data safety and monitoring concepts

Types of form for clinical trials - baseline assessment, evaluation form, flow sheet, layout and design, missing, range and logicalchecks, data transfer

Unit VIII: Analysis of data from clinical trials

Describing clinical trials data-qualitative and quantitative, prognostic, adjustment for prognostic factors

Essential Reading List

1. *Pocock S. J.:* Clinical Trials: A Practical Approach. Michigan, Wiley Medical Publication, 1983.
2. *Everitt B.S., Pickels, A.:* Statistical Aspects of the Design and Analysis of Clinical Trials, ed. 2. London, Imperial College Press, 2004.
3. *Friedman L. M., Furberg, C.D., DeMets, D. L.:* Fundamentals of Clinical Trials. Boston, PSG, 1982.

Suggested Reading List

1. Dean, A., Voss, M: Design and Analysis of Experiments.
2. Federer, W.T.: Experimental Designs- Theory and Methods. Oxford & IBH.
3. Das, M.N. and Giri, N.C.: Design and Analysis of Experiments. Wiley Eastern.

Elective Courses

MBD E-1.1	Data Analysis with R and Python	45 Hours

Course Outcomes:

CO1: Learn open source softwares R and Python for data analysis.

CO2: Learn exploratory data analysis with R and Python.

CO3: Learn use of R and Python programming for model development.

R

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

Python

Unit I: Introduction

Introduction to Python; advantages of python over other programming languages; Python packages for data science

Unit II: Importing dataset

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

Unit III: 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 IV: 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 V: 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. Wes McKinney, Python for Data Analysis, O'Reilly Media, Inc., 2017.
4. Samir Madhavan, Mastering Python for Data Science, Packt Publishing, 2015.

Suggested Reading List

1. Download and install R from https://cran.r-project.org/
2. Download RStudio from www.rstudio.com
3. Video Tutorials on Installing R on windows
4. Video Tutorials for Installing R on Mac

MBD E 1.2	Data Analysis with STATA	45 Hours

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.

MBD E-2.1	Introduction to Longitudinal Data Analysis	45 Hours

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 STATA/SAS

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.

MBD E-2.2	Introduction to Spatial Statistics	45 Hours

Course Outcomes:

CO1: Learn basic spatial concepts and cartography.
CO2: Learn basic spatial statistics.
CO3: Learn spatial regression models and their application.
CO4: Learn softwares used for estimating spatial statistics.
CO5: Learn application of spatial statistics using ArcGIS and Geoda.

Unit I: Introduction to spatial statistics

Unit II: 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

Unit III: Basic Spatial Statistics

Exploratory spatial data analysis (ESDA); Moran's I; local indicators of spatial association (LISA) – univariate and bivariate; kriging; spatial pattern analysis

Unit IV: Spatial Regression Models

Lag and error regressions; multilevel models; geographically weighted regression

Unit V: Introduction to Geospatial Software

Geographic Information System (GIS) - discrete data, point, and polygondata; raster and vector data; layouts preparation; geocoding and basics of digitization in ArcGIS; Geoda

Unit VI: Application of spatial statistics using ArcGIS and Geoda

Essential 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. (1995): Interactive Spatial Data Analysis. Harlow, Longman.
3. ESRI (1993): Understanding GIS. Redlands, USA

Suggested Reading list:

1. Parker R. N., Asencio E. K. (2008). GIS and Spatial Analysis for the Social Sciences: Coding, Mapping, and Modeling. New York, NY, Routledge/Taylor & Francis.
2. Zhu E J. and Chi G. (2008). Spatial Regression Models for Demographic Analysis. Population Research Policy Review 27:17–42 DOI 10.1007/s11113-007-9051-8
3. Sparks Corey. (2013). *Spatial Analysis in R: Part 1*. Spatial Demography 1(1) 131-139
4. Sparks Corey. (2013). *Spatial Analysis in R: Part 2*. Spatial Demography 1(2) 219-226

MBD E-3.1	Systematic Review and Application of Meta-Analysis	30 Hours

Course Outcomes:
CO1: Learn and describe the process and the uses of systematic reviews and meta-analyses.
CO2: Learn skills required for performing basic systematic reviews and meta-analyses.

Unit I: Introducing the systematic reviews
Need for a systematic review, difference between a narrative and a systematic review. Producers and users of systematic reviews, systematic review for randomized control trials and observational studies, and main challenges in systematic reviews.

Unit II: Developing a protocol for a systematic review
Determining scope of a review, defining the research question, framing the question (PICO/PECO), deciding the type and scope of the question, defining specific inclusion and exclusion criteria, Introduction to the Cochrane Collaboration, examples of questions and inclusion/exclusion criteria from Cochrane.

Unit III: Developing an analytic framework for review
Searching strategy, identifying key sources and techniques for searching, using databases for searching articles, building a high-quality search strategy, documenting search conclusions, reference management

Unit IV: Meta-analysis
Why do a meta-analysis?, strengths and weaknesses compared to narrative literature reviews. General steps of a meta-analysis, Hypotheses and problems in research synthesis, Types of data and summary measures, Statistical methods for meta-analysis, effect sizes, standardised mean difference, cumulative meta-analysis, fixed effect model, random effect model and summary effects

Unit V: Biases in the systematic review and meta-analysis
Selection bias, information bias and analysis bias. Heterogeneity, minimising meta-bias, meta regression, and handling within study dependency.

Unit VI: Reporting guidelines and tools
PRISMA, MOOSE, Screening i.e. Rayaan, EPPI-Reviewer, Covidence, DistillerSR. Qualitative synthesis, Interpreting results and their presentation.

Essential Reading List

1. Egger, M., Smith, G. D., & Altman, D. (Eds.). (2008). Systematic reviews in health care: meta-analysis in context. John Wiley & Sons.
2. Higgins, J. P., Thomas, J., Chandler, J., Cumpston, M., Li, T., Page, M. J., & Welch, V. A. (Eds.). (2019). Cochrane handbook for systematic reviews of interventions. John Wiley & Sons. Online version available at https://training.cochrane.org/handbook/current
3. Borenstein, Michael, Larry V. Hedges, Julian PT Higgins, and Hannah R. Rothstein. Introduction to meta-analysis. John Wiley & Sons, 2021.

Suggested Reading List

1. Card, Noel A. Applied meta-analysis for social science research. Guilford Publications, 2015.
2. Macaskill, Petra, Constantine Gatsonis, Jonathan Deeks, Roger Harbord, and Yemisi Takwoingi. "Cochrane handbook for systematic reviews of diagnostic test accuracy." (2010).
3. Leandro, Gioacchino. Meta-analysis in medical research: The handbook for the understanding and practice of meta-analysis. John Wiley & Sons, 2005.

MBD E-3.2	Large-scale Sample Surveys	30 Hours

Course Outcomes:

CO1: Learn determination of sample size in a large-scale household survey and its allocation at the state and district levels.
CO2: Learn basic concepts of sampling frame and construction and maintenance of sampling frame.
CO3: Learn tools for monitoring the quality of data in large-scale household surveys.
CO4: Learn how to develop data collection software.
CO5: Learn estimation of sampling weight in large-scale household surveys.

Unit I: Scope of large-scale surveys and sampling design

Need for large scale surveys; objectives of cross-sectional, longitudinal, rotational, and interpenetrating surveys; sample size determination and sample allocations for such surveys to districts, states and regions in terms of individuals, households and primary sampling units.

Unit II: Sampling frames

Sources of sampling frame for cross-sectional, longitudinal, rotational and interpenetrating surveys; explicit and implicit stratifications; domain-controlled sampling by regions and social groups; merging and segmentation procedures for small and large primary sampling units; mapping and household listing for preparation of frame for last stage sampling units; sample selection of PSUs and households.

Unit III: Quality assurance procedures

Revisit of sub-samples; field check tables; non-response pattern; roles of supervisors, editors, field and nodal agencies; third party audit.

Unit IV: Software development

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.

Unit V: Ethical considerations in large-scale sample surveys

Unit VI: Estimation of sampling weights

Essential Reading List

1. United Nations (2005): Household Sample Surveys in Developing and Transition Countries. www.unstats.un.org/unsd/hhsurveys/
2. CSPro Software. www.census.gov/data/software/cspro.Download.htm
3. Roy, T.K., Acharya R., Roy, A.K. (2016). Statistical survey design and evaluatingimpact, Cambridge University Press, New Delhi.

Suggested Reading List

1. Kish, Leslie, (1995): Survey Sampling, John Wiley and Sons, Inc. New York.
2. Lohr L. Sharaon., (1999): Sampling: Design and Analysis, Duxbury Press, London
3. Ladusingh, L. (2018). Survey Sampling Methods, PHI Learning, New Delhi

MBD E-4.1	Concepts and Measures of Global Health	45 Hours

Course Outcomes:

CO1: Learn basic concepts and importance of global health.
CO2: Learn the basic concepts and methods used for studying global burden of disease.
CO3: Learn determinants of health.
CO4: Learn functioning of health care delivery system.

1. **Concept and introduction**: Concept of global health; importance to study global health, global variation in demographic, health and epidemiological transitions; linkages between globalization and health; linkages between global and local health; current challenges, emerging trends and priorities in global health; major patterns of distribution of disease in the world; sources of data on disease and disability.
2. **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, age and gender? GBD 1990, 2010 and 2019 - changes and continuities.
3. **Infectious Diseases, Non-Communicable Diseases (NCDs) and Nutrition**: Persistence of infectious diseases in developed and low- and middle-income countries; new and re-emerging infectious diseases across globe; difficulty in prevention, treatment, and rehabilitation from infectious diseases. Current and growing challenge of NCDs in developed and low- and middle-income countries; NCD's epidemiology in developed and low- and middle-income countries. Double burden of malnutrition and diseases in low- and middle-income countries; food security of undernutrition; short-term and long-term impact of undernutrition; nutrition transition.
4. **Determinants of Health**: Factors responsible for variation in the global burden of disease - culture, race, ethnicity, education, socio-political establishment, economic development and economic inequality. Role of water, sanitation, indoor and outdoor air pollution, food security, migration, disaster (man-made, natural), conflicts and epidemics in explaining global health disparities.
5. **Health care delivery systems**: Introduction to health systems; components of health system; financial models of health care; service delivery models; governments role in delivering health care; measurement of health system performance in developed and developing countries; role of WHO, World Bank, etc. in setting global and national health priorities.

Essential readings

1. Skolnik, R. (2008). Essentials of global health, Jones and Bartlett: Sudbury, MA.
2. 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.
3. Council on Foreign Relations. (2014). The Emerging Global Health Crisis. Non-Communicable Diseases in Low- and Middle-Income Countries. Independent Task Force Report No. 72. https://www.cfr.org/sites/default/files/report_pdf/TFR72_NCDs.pdf
4. World Health Organization. (2017) Double Burden of Malnutrition. http://www.who.int/nutrition/double-burden-malnutrition/en/

Suggested readings

1. Hoffmann SJ. (2010). The Evolution, Etiology and Eventualities of the Global Health Security Regime. Health Policy Plan 25(6): 510-22. https://www.ncbi.nlm.nih.gov/pubmed/20732860
2. 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.
3. Dielman JL, Schneider MT, Haakenstad A, Singh L, Sadat N, Birger M, Reynolds A, Templin T, Hamavid H, Chapin A, Murray C. (2016) Development Assistance for Health: Past Trends, Associations, and the Future of International Financial Flows for Health. Lancet 387; 2536 – 44.
4. Murray, C.J.L., Frenk, J. (2000). A framework for assessing the performance of health systems, Bulletin of the World Health Organization 78(6): 717-731.
5. Mozaffarian D. (2017). Global Scourge of Cardiovascular Disease. Time for Health Care Systems Reform and Precision Population Health. Journal of the American College of Cardiology 70(1): 26 – 8.
6. Mills, A., Rasheed, F., Tollman, S. (2006). Strengthening health systems, In Disease Control Priorities in Developing Countries (2nd Edition), pages 87-102, New York: Oxford University Press.
7. Hsiao, W.C. (2003). What is a health system? Why should we care? Harvard School of Public Health Working Paper.
8. World Health Organization (2010). Key Components of a Well-Functioning Health System. http://www.who.int/healthsystems/publications/hss_key/en/
9. Fried LP, Bentley ME, Buekens P, Burke DS, Frenk JJ, Klag MJ et al. (2010). Global Health is Public Health. Lancet 375, 535 – 7.

MBD E-4.2	Big Data using Machine Learning	45 Hours

MBD E-4.3	Health Economics and Health Financing	45 Hours

Course Outcomes:

CO1: 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.
CO3: To familiarize the means and measures of health financing.
CO4: To understand the determinants of health insurance and its coverage.
CO5: 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

IV. **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 utilization: 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. 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

VII. 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 READINGs:

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. 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.
3. O'Donnell O, Doorslaer E v, Wagstaff A and Lindelow M. Analyzing Health Equity Using Household Survey Data (2008), AGiide to Techniques and Their Implementation
4. Xu K (2005). Distribution of health payments and catastrophic expenditures Methodology World Health Organization.

SUGGESTED READINGs

1. 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.
2. Grossman (1982), On the concept of Health capital and Demand for Health, Journal of Political Economy, 80(2)

3. Macintyre S (1997). The Black Report and Beyond-What are the issues, Social Science, Medicine, 44(6):723-745
4. Mohanty, S. K., & Dwivedi, L. K. (2021). Addressing data and methodological limitations in estimating catastrophic health spending and impoverishment in India, 2004–18. International journal for equity in health, 20(1), 1-18.
5. Ringel etal (2005) The Elasticity of Demand for Health Care A Review of the Literature and Its Application to the Military Health System
6. Victoria Y Fan and William D. Savedoff (2014), "Health Financing transition: A conceptual framework and empirical evidences, Social Science Medicine, 105 (2014):112-121
7. Wagstaff A, P. Paci and E van Doorslaer (1991), On the measurement of inequalities in health, Social Science and Medicine 33(5), 545-557
8. Wagstaff, Adam & van Doorslaer, Eddy, 2000. "Chapter 34 Equity in health care finance and delivery," Handbook of Health Economics, in: A. J. Culyer & J. P. Newhouse (ed.), Handbook of Health Economics, edition 1, volume 1, chapter 34, pages 1803-1862 Elsevier

MBD E-5.1	Population Ageing and Health Transition	45 Hours

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.

CO4: Familiarize with aging data sets and its exploration.

CO5: Learn ageing policies and programmes and its bearing on the welfare of the elderly.

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; population ageing 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.

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 Health Care 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 of Indian 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.

MBD E-5.2	Population, Environment and Sustainable Development	45 Hours

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.*

MBD E-5.3	Gender, Health and Development	45 Hours

Course Outcomes:

CO1: To sensitise 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 providers
Nutritional 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 health inequalities and health outcomes
Gender dimension of social development, status and role of men and women in household and community, 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 domestic

violence 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 Millennium Development 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 and development 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, anddemographic 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 and Development Review*. 18(1): 105-112.
7. Gita Sen, Adreinne Germain and Lincoln C. Chen, (Eds.), (1994): *Population PoliciesReconsidered:*

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, New Delhi.
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 University Press, New York.
9. Harriet B. Presser, (1997): Demography, Feminism and the Science-policy Nexus, *Population and Development 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

MBD E-6.1	Operations Research in Population and Health	45 Hours

Course Outcomes:

CO1: Learn the concept of operations and intervention research in reproductive health and related fields.
CO2: Differentiate the operation research from other social science research.
CO3: Identify research problems, design and methodology in operation research.
CO4: Capacity to prepare proposal for operation research and its implementation.

Unit I: Introduction

What is operations research; focus and objective of operations research; types and examples of operations research; role of researchers and managers; components of operations research proposal; critiques to operations research proposal

Unit II: Identification of problem and solution

Identification and definition; justification; alternative solution; indicators - outputs, outcomes and impacts

Unit III: Causality (Randomize Experimental Design)

Pretest-posttest control group design; Posttest –only control group design; multiple treatment design

Unit IV: Quasi/non-experimental design

Non-experimental control design; time series design; before and after design

Unit V: Inferential statistics in operations research

T^2, t, and F tests; deciding sample size in case of different experimental design; linking different design and statistical tests

Unit VI: Study design exercises

Unit VII: Ethics in operations research

ICMR guidelines; international perspectives; case studies

Unit VIII: Utilization and dissemination, and process documentation

Essential Reading List

1. Fisher, Andrew A., James R. Foreit, J. Laing, J. Stoeckel and J. Townsend 2002: Designing HIV/AIDS Intervention Studies-An Operations Research Handbook, Population Council, New York.
2. Foreit, James R. and Tomas Frejka 1998: Family Planning Operations Research-A Book of Reading, Population Council, New York
3. Kish, Leslie 1965: Survey Sampling, New York, John Wiley and Sons.

MBD E-6.2	Monitoring and Evaluation in Population and Health	45 Hours

Course Outcomes:

CO1: Develop M & E framework and statistical analysis plan.
CO2: Demonstrate an understanding of the essential principles and design of program evaluation.
CO3: Learn statistical methods used in evaluation Program.
CO4: Understand Ethical issues in evaluation research.
CO5: Understand public interventions related to health and family welfare.

Unit I: Introduction to monitoring and evaluation

Basic concepts, difference between monitoring and evaluation; linkage between planning, monitoring and evaluation; importance of monitoring and evaluation

Unit 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

Unit III: Monitoring of policy implementation

Components of policy and programme, budget, staff, process of evaluation, developing tangible indicators for policymonitoring in terms of input, process, output, outcome, impact; result based inference

Unit 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

Unit 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 dependent cluster design, interrupted time series analysis.

Unit VI: Assuring the quality of evaluation design and methodology

Overview; defining the context; the evaluation purpose; focusing the evaluation; evaluationmethodology; mandatory requirements for programme; SWOT analysis of NHM, ICDS and National Livelihood Mission; social audit – meaning, objectives, advantage, case study of social audit

Unit VII: Statistical approaches for 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

Unit VIII: Management information system and use of technology
MIS – monitoring information system; role of programmers; HMIS system; global positioningsystem; Use of machine learning and artificial intelligence, use of spatial data

Essential 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. IFRC and RCS (2002). Handbook for Monitoring and Evaluation. International Federation of Red Cross and Red Crescent Societies –Geneva

Suggested Reading List:

1. McLean R. and Gargani J. (2019) Scaling Impact Innovations for the Public Good. Routledge, New York.
2. United nations development Group. The Theory of Change, UNDAF Campanion Guideline.
3. UNDP (2009). Handbook on planning, monitoring and evaluating for development results. United Nations Development Programme - New York
4. 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: Management Sciences for Health, 2007

MBD E-6.3	Urbanization, Space and Planning	45 Hours

Course Outcomes:

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

Unit 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

Unit 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.

Unit III: Urban and Regional Planning

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

Region: concept and definition, types (formal, functional and 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.

Concepts; history and origins of urban planning; pioneers ofurban 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

Unit IV: Challenges in Urban planning

Recent urban policies and programmes; Urban redevelopment; Urban poverty, urban housing and real estate, Slums and slum rehabilitation, Urban pollution, Solid waste management; Management of migrants; Case studies of rehabilitation programs (SRA)

Unit V: Remote Sensing, GIS and Urban and Regional Planning

Application of Remote Sensing and GIS in urban and regional planning.

Essential Readings:

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

Suggested Readings:

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 PoliticalWeekly, 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 evolutionof*

regionalplanning, Edward Arnold, London.
16. Kawashima, T and P. Korcelli, (1982), *Human Settlement Systems: Spatial Patternsand Trend*, IIASA, Luxemburg.
17. Knowles, R and J. Warling, (1983), *Economic and Social geography: MadeSimple*, 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.

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

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Master of Science in Biostatistics & Demography

Course Code	Name of the Course	Course type	Credits	No. of hours	No. of Internals*	Weightage (%)	
						Internal Exam	Semester Exam
	Semester-I						
MBD-F1	Basics of Human Biology	F	NC	45	3	50	50
MBD-F2	Social Science Concepts	F	NC	45	3	50	50
MBD-C1	Introduction to Demography and History of Population	C	3	45	3	40	60
MBD-C2	Basic Demographic Methods	C	3	45	3	40	60
MBD-C3	Methods in Biostatistics I	E	2	30	2	40	60
MBD-C4	Sample Survey Designs	E	2	30	2	40	60
MBD-E1	MBD E-1.1: Data Analysis with R and Python	E	3	45	3	50	50
	MBD E-1.2: Data Analysis with STATA			45	3	50	50
		Total	**13**				
	Semester-II						
MBD-C5	Basic Concepts and Application of Epidemiology	F	3	45	3	40	60
MBD-C6	Infectious Disease Epidemiology	C	2	30	2	40	60
MBD-C7	Methods in Biostatistics II	C	2	30	2	40	60
MBD-C8	Healthcare Systems and Policies	C	2	30	2	40	60
MBD-C9	Demographic Theories and Nuptiality	C	2	30	2	40	60
MBD-C10	Advanced Sample Survey Designs and Related Concepts	C	2	30	2	40	60
MBD-E2	MBD E-2.1: Introduction to Longitudinal Data Analysis MBD E-2.2: Introduction to Spatial Statistics	E	3	45	3	50	50
MBD-E3	MBD E-3.1: Systematic Review and Application of Meta-Analysis MBD E-3.2: Large-scale Sample Surveys	E	2	30	2	50	50
MBD-V1	Viva-voce	V1					
		Total	**20**				
	Semester-III						
MBD-F3	Introduction to Demographic Packages	F	NC	45	3	50	50
MBD-C11	Research Methods in Epidemiology and Biostatistics	C	4	45	3	40	60
MBD-C12	Advanced Demographic Methods	C	3	45	3	50	50
MBD-C13	Advanced Methods in Biostatistics	E	2	30	2	40	60
MBD-E4	MBD E-4.1: Concepts and Measures of Global Health MBD E-4.2: Big Data using Machine Learning MBD E-4.3: Health Economics and Financing	E	3	45	3	50	50
MBD-E5	MBD E-5.1: Population Ageing and Health Transition MBD E-5.2: Population, Environment and Sustainable Development MBD E-5.3: Gender, Health and Development	E	3	45	3	40	60
MBD-C14	Survival Analysis	C	3	45	3	50	50
		Total	**18**				
	Semester-IV						
MBD-C15	Data Management and Analysis in SAS	C	3	45	3	50	50
MBD-C16	Demographic Models and Indirect Methods of Estimation	C	3	45	3	50	50
MBD-C17	Methods in Clinical Trials	C	3	45	3	40	60
MBD-E6	MBD E-6.1: Operations Research in Population and Health MBD E-6.2: Monitoring and Evaluation in Population and Health MBD E-6.3: Urbanization, Space and Planning	E	3	45	3	50	50
MBD-D	Dissertation	D[$]	10				
MBD-V2	Viva-voce	V2	2				
		Total	**24**				
	Total Credits		**75**				

Notes:

Course type: F – Foundation course; C – Core course; E – Elective course; V – Viva voce; D – Dissertation.
NC: Non-credited foundation courses are not counted for calculating the final grade.
Core papers: Must for all students and cannot be changed.
Elective papers: One elective paper should be opted from a pair.

Internal Examination: Teachers are given the flexibility to decide mode of mode of internal examination from the following list: Written Test; Open Book Test; Written Home Assignment; Individual Thematic Presentation; Thematic Group Presentation; Group Discussion; Surprise Test; MCQ Test; Case Study; Situation Analysis (group activity or individual activity); Field Visit; Small Group Project & Internal Viva-Voce; Role Play / Story Telling; Literature Review / Book Review; Model Development/Simulation Exercises (Group Activity or Individual Activity); In-depth Viva; Quiz; etc.

Dissertation: Weightage for evaluation of dissertation: Guide 0.25; Presentation & Defence 0.25; and Content 0.50.

Evaluation of Dissertation: The Director & Senior Professor appoints an evaluation committee for dissertation consisting of three members from among the faculty of IIPS. First, the committee members independently assess the 'oral presentation and defence' of the student and submit their grade to the Controller of Examinations. Second, the committee members independently evaluate the content of the 'final dissertation' submitted by the student and submit their grades to the Controller of Examinations. To arrive the final dissertation grade, the average of overall grades of Guide, Presentation & Defence, and Content is considered.

Best Dissertation Award: The Director & Senior Professor appoints a committee consisting of three external experts for recommending the award of the best dissertation. The dissertations of top five ranks (based on the combined score of content, presentation and defence) are placed before the committee. The external members evaluate dissertations and submit their recommendation in a sealed cover to the Controller of Examinations.

Viva voce: Director & Senior Professor constitutes a committee comprising of one external examiner and three/four internal examiners for the viva-voce. The three/four internal examiners shall comprise of one senior professor (Chairperson), one/two faculty members and one programme co-ordinator. The committee members independently evaluate the performance of the students in the viva-voce and assign their grades. To arrive the final viva-voce grade, the average of the evaluation of the members is considered.

Grades Table

GRADE TABLE FOR EVALUATION OF ANSWER SHEET

The Grades, Grade Point and Descriptions are as given below

Final Grade	Grade Point	Grade Description
O Only	10	Outstanding
A Plus	9	Excellent
A Only	8	Very Good
B Plus	7	Good
B Only	6	Above average
C Only	5	Average
P Only	4	Pass
F3	3	Fail
F2	2	Fail
F1	1	Fail
NA/AB	0	Not Attempted / Absent

GRADE TABLE FOR SEMESTER GRADE CARD

The Grades, Grade Point and Descriptions are as given below

Final Grade	Grade Point	Grade Description
O Only	10	Outstanding
A Plus	9	Excellent
A Only	8	Very Good
B Plus	7	Good
B Only	6	Above average
C Only	5	Average
P Only	4	Pass
F Only	0	Fail
NA/AB	0	Not Attempted / Absent

20/7/23

24/07/23

26/07/23