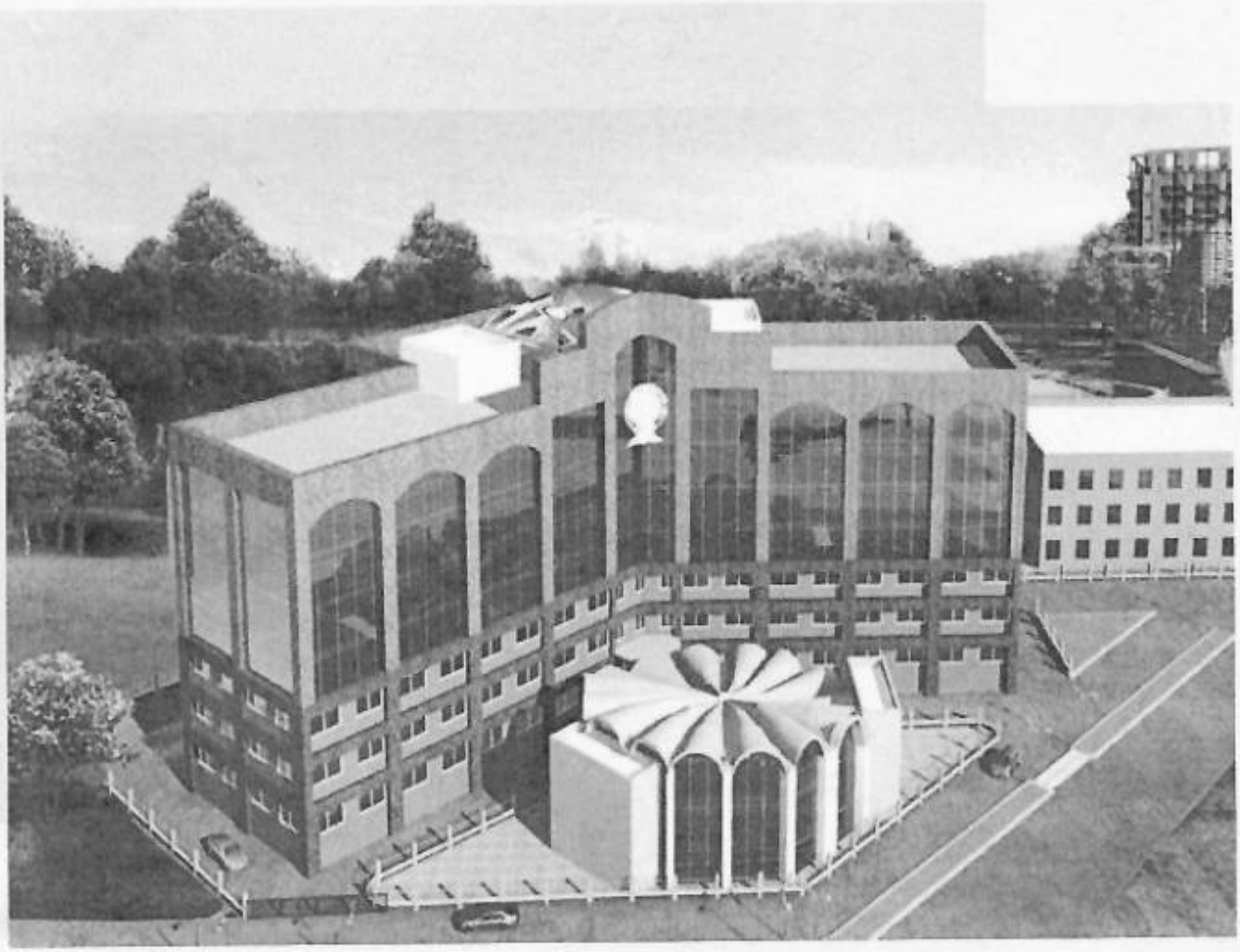

Master of Science in Biostatistics and Demography

Syllabus

Approved by the Academic Council on 08 May 2025

(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**

Programme Outcomes:

- To develop skilled biostatisticians and demographers with expertise in data analysis for public health and population studies.
- To enhance the application of statistical methods in demographic research, epidemiology, and health sciences.
- To equip students with analytical tools for evidence-based policy formulation and program evaluation.
- To foster an interdisciplinary approach integrating biostatistics, demography, and social sciences.
- To prepare students for careers in research, academia, and data-driven decision-making at national and international levels.

Index to the course

Course Code	Course Name	Course Type	Credits	Hours	L	T	P
	SEMESTER I						
IKS 401	Indian Knowledge System-1	IKS	2	30	2	0	0
MBD F401	Basics of Human Biology	F	2	30	2	0	0
MBD F402	Social Science Concepts	F	3	45	2	1	0
MBD C401	Introduction to Demography and Data Source	C	3	45	2	1	0
MBD C402	Basic Demographic Methods	C	3	45	2	1	0
MBD C403	Methods in Biostatistics I	C	2	30	1	1	0
MBD C404	Sample Survey Designs	C	2	30	2	0	0
MBD C405	Basic Concepts and Application of Epidemiology	C	2	30	1	1	0
MBD E401	Programming with R	E	2	45	1	0	1
MBD E402	Data Analysis with STATA						
	Semester Credits		**21**	**330**			
	SEMESTER II						
MBD F403	Introduction to Demographic Packages	F	2	30	1	1	0
MBD C501	Infectious Disease Epidemiology	C	2	30	2	0	0
MBD C502	Methods in Biostatistics II	C	2	30	2	0	0
MBD C503	Healthcare Systems and Policies	C	2	30	1	1	0
MBD C504	Demographic Theories and Nuptiality	C	2	30	1	1	0
MBD C505	Advanced Sample Survey Designs	C	2	30	2	0	0
MBD C506	Survival Analysis	C	3	45	2	1	0
MBD E501	Large-scale Sample Surveys	E	2	30	1	1	0
MBD E502	Spatial Analytics			45	1	0	1
MBD E503	Programming for Data Analysis with Python						
MBD E511	Urbanization, Space and Planning	E	3	45	2	1	0
MBD E512	Introduction to Longitudinal Data Analysis						
MBD V1	Viva-voce	V1	2				
VAC 401	Value added Course	VAC	NC	30			
MBD I	Internship	I	NC				
	Semester Credits		**22**	**345**			
	Year 1 Credits		**43**	**675**			
	SEMESTER III						
IKS 501	Indian Knowledge System-2	IKS	2	30	2	0	0
MBD C507	Research Methodology	C	2	30	1	1	0
MBD C508	Advanced Demographic Methods	C	2	30	1	1	0
MBD C509	Advanced Methods in Biostatistics	C	2	30	2	0	0
MBD C510	Data Management and Analysis in SAS	C	2	45	1	0	1
MBD C511	Demographic Model and indirect methods of Estimation	C	2	30	1	1	0
MBD E521	Concepts and Measures of Global Health	E	3	45	2	1	0
MBD E522	Artificial Intelligence and Machine Learning Applications						
MBD E523	Health Economics and Financing						
MBD E524	Monitoring and Evaluation in Population and Health						

MBD E531	Population Ageing and Health Transition	E	3	45	2	1	0
MBD E532	Gender, Health and Development						
MBD E533	Operations Research in Population and Health						
MBD E534	Population, Environment and Sustainable Development						
MBD E535	Occupational Health						
MBD C512	Methods in Clinical Trials	C	3	45	2	1	0
Semester Credits			**21**	**330**			
SEMESTER IV							
MBD R501	Research Field Work	R	6	90			
MBD R511	Review paper	R	3	60			
MBD R521	Project on Data Analytics	R	3	60			
MBD R531	Dissertation	R	8	120			
MBD V2	Viva-Voce-II	V2	2				
Semester Credits			**22**	**330**			
Year 2 Credits			**43**	**660**			
TOTAL CREDITS (including 4 credits of viva-voce)			**86**	**1335**			

Notes:

- IKS-Indian Knowledge System course, F-Foundation course, C- Core course, E-Elective course, R-Research, VAC-Value Added Course, V-Viva voce, D- Dissertation, L-Lecture, T-Tutorial and P-Practical.
- NC: Non-Credited courses are not counted for calculating the final grade.
- Core course: Must for all the students and cannot be changed.
- Elective course: One elective course should be opted from a pair.
- Semester I: One elective should be opted from E401/ E402
- Semester II: One elective should be opted from each group i.e. E501/ E502/ E503; E511/ E512
- Semester III: One elective should be opted from each group; i.e. E521/ E522/ E23/ E24; E531/ E532/ E533/ E534/ E35

SEMESTER I

Course Code: IKS 401

Course Title: INDIAN KNOWLEDGE SYSTEM-1

Credit: 02
(Lecture: 2)

Hours: 30

COURSE OUTCOMES:

- To focus on the scientific and eternal Indian Knowledge System
- To know the diverse path of spirituality in India and its application in the management of modern life
- To know the contributions of the Indian Knowledge System to the world
- To understand population-related topics within the framework of the Indian Knowledge System

COURSE CONTENT:

Link from SWAYAM to be shared with the students by the coordinator.

Course Code: MBD F401

Course Title: BASICS OF HUMAN BIOLOGY

Credit: 2
(Lecture: 2)

Hours: 30

COURSE OUTCOMES:

- Aware of the basics of human biology.
- Understand the human life cycle and its bearing on health and diseases.
- Familiarity with anatomy and physiology of different organ systems of the human body.
- Acquire basic knowledge about the pathophysiology of human organ systems.

COURSE CONTENT:

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)

READING LIST:

Guyton, A. C. (1991). *Textbook of medical physiology*. A Prism Book Pvt. Ltd.

Horton, C. (1994). *Atlas of anatomy*. Marshall Cavendish Books.

Keele, N., et al. (1991). *Samson Wright's applied physiology*. Oxford University Press.

Sears, W. G., Winwood, R. S., & Smith, J. L. (1985). *Anatomy and physiology for nurses and students of human biology*. Education Academic and Medicinal Publishing Division of Hodder and Stoughton.

Sembulingam, K., & Sembulingam, P. (2019). *Essentials of medical physiology*. Jaypee Brothers Medical Publishers.

Course Code: MBD F402

Course Title: SOCIAL SCIENCE CONCEPTS

Credit: 3 **Hours: 45**
(Lecture: 2, Tutorial: 1)

COURSE OUTCOMES:

- To gain familiarity with basic social science concepts that has bearing on understanding population dynamics.
- 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.
- Viewing population in space and time and read population geography in consideration of man- environment relationship, geographical factors and regional perspective.
- Recognition of interplay between economic development and population changes in an evolving world order.
- To understand the psychological concepts like perception, behaviour, emotion, personality, coping mechanism, communication and their bearing on Population Studies

COURSE CONTENT:

SOCIOLOGY

Sociology: sociology as a social science- its nature, subject matter and scope

Relation of sociology with other social sciences, sociological perspective

Basic Concepts in sociology

The Family:

a) Sociological Significance of the Family b) Types and functions of Family

b) Nuclear and joint families

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

Kinship –features of kinship system in India, regional variations

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

Socialization: agencies of socialization

Culture: meaning and characteristics of culture.

Society and Culture in India

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

Caste System

i) Concept and definition of Caste System,
ii) Changing Caste System in India

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

Social Change

Definition and Concept of Social Change

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

a) Sanskritization
b) Westernization
c) Modernization

GEOGRAPHY

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

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

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

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

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

sciences.

ECONOMICS

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

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

Basic Concepts in Macro Economics: Basic Concepts in National Income: Concept of GDP, NDP, GNP, NNP, NI, PCI, 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

Social Psychological Concepts: The Value of psychology and perspectives in psychology; scientific study of social influences on behavior and the interaction between individuals and groups; social pressure, leadership

Basics of Psychology: Why Psychology, branches of psychology, methods of research, psychological wellbeing across major stages of the life span. Role of psychology in population studies.

READING LIST:

Ahuja, H. L. (1972). *Advanced economic theory: Microeconomic analysis* (Chapters 5, 6, 7, 8, 9, 12, 16, 17, 18, 20). S. Chand and Company Limited.

Abler, R., Adams, J., & Gould, P. (1971). *Spatial organization: The geographer's view of the world*. Prentice Hall.

Burkeman, O. (2012). *The antidote: Happiness for people who can't stand positive thinking*.

Carl Gustav Jung. (1964). *Man and his symbols*.

Dasgupta, A. K. (1970). *Epochs of economic theory* (Chapters 2, 3, 4, 7, & 8). Oxford University Press.

Datt, R., & Sundaram, K. P. M. (2000). *Indian economy* (Part II). S. Chand & Company Ltd.

Davis, K. (1975). *Human society* (Chapters 1, 3, 5, 6). MacMillan and Co.

Duhigg, C. M. (2012). *The power of habit*.

Freud, S. (1900). *The interpretation of dreams*.

Government of India, Ministry of Finance, Economic Division. *Economic survey*.

Haralambos, M. (1980). *Sociology: Themes and perspectives*. Oxford University Press.

Horney, K. (1937). *The neurotic personality of our time*.

Johnson, H. M. (1966). *Sociology: A systematic introduction*. Allied Publishers.

Jung, C. G. (1964). *Man and his symbols*.

Kapadia, K. M. (1966). *Marriage and family in India*. Oxford University Press.

Kalat, J. W. (2013). *Introduction to psychology* (10th ed.).

Koutsoiannis, A. (1979). *Modern microeconomics*. Macmillan Press Ltd.

Kuppuswamy, B. (1972). *Social change in India*. Konark Publication Pvt. Ltd.

Lipsey, R. G., & Chrystal, K. A. (2004). *Economics* (Part One, Part Two, and Part Five). Oxford University Press.

Mac Iver, R. M., & Page, C. H. (1949). *Society: An introductory analysis* (Chapters 1, 3, 7, 11, 15, 22, 24, 25, 26). Holt, Rinehart, and Winston.

Mandelbaum, D. G. (1970). *Society in India: Continuity and change* (Vol. 1) and *Change and continuity* (Vol. 2). University of California Press.

McGee, R. (1980). *Sociology: An introduction*. Holt, Rinehart, and Winston.

Magill, F. N. (Ed.). (1995). *International encyclopedia of sociology*. Fitzroy Dearborn Publishers.

Muzumdar, H. (1966). *The grammar of sociology: Man in society*. Asia Publishing House.

Peet, R. (1998). *Modern geographic thought*. Blackwell Publishers.

Samuelson, P. A., & Nordhaus, W. D. (2004). *Economics* (Parts One, Two, and Five). Tata McGraw Hill.

Sigmund Freud. (1900). *The interpretation of dreams*.

Singh, R. L. (1971). *India: A regional geography*. National Geographical Society of India.

Srinivas, M. N. (1966). *Social change in modern India*. University of California Press.

Course Code: MBD C401

Course Title: INTRODUCTION TO DEMOGRAPHY AND DATA SOURCE

Credit: 3 **Hours: 45**
(Lecture: 2, Tutorial: 1)

COURSE OUTCOMES:

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

COURSE CONTENT:

Concepts, 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; Population composition, 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

Global and National Population Trends

Global population trends - 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; Trends and growth of India's population; concerns of population growth- before and after independence,

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, publication of census data/ reports; registration of births and deaths act 1969Vital 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).

Population Theories

Malthus and Marx; optimum population; demographic transition theory-5

READING LIST:

Bogue, D. (1969). *Principles of demography*. John Wiley and Sons.

Bhende, A. (1996). *Principles of population studies* (7th ed.). Himalaya Publishing House.

Davis, K. (1968). *The population of India and Pakistan*. Russell and Russell.

Jacob, S. S., & Swanson, D. A. (2004). *The methods and materials of demography* (2nd ed.). USA.

John, W. (2005). *Population: An introduction to concepts and issues* (9th ed.). Wordsworth Learning.

Livi-Bacci, M. (1996). *A concise history of world population* (2nd ed.). Oxford University Press.

United Nations. (1973). *The determinants and consequences of population trends* (Vol. I, Population Studies No. 50, Chapter VII). New York.

Course Code: MBD C402

Course Title: BASIC DEMOGRAPHIC METHODS

Credit: 3 **Hours: 45**
(Lecture: 2, Tutorial: 1)

COURSE OUTCOMES:

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

COURSE CONTENT:

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

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

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.

READING LIST:

Bhende, A. A., & Kanitkar, T. (2003). *Principles of population studies* (16th rev. ed.). Himalaya Publishing House.

Hinde, A. (1998). *Demographic methods*. Arnold.

Pathak, K. B., & Ram, F. (1998). *Techniques of demographic analysis* (Chapter 4, pp. 108–153). Himalaya Publishing House.

Preston, S., Heuveline, P., & Guillot, M. (2001). *Demography: Measuring and modeling population processes*. Wiley-Blackwell.

Shryock, H. S., Siegel, J. S., & Associates. (1980). *The methods and materials of demography* (Vol. 1 & 2). U.S. Bureau of the Census.

United Nations. (1974). *Methods of measuring internal migration* (Manual VI). UN.

Weeks, J. R. (2005). *Population: An introduction to concepts and issues* (9th ed.). Wadsworth Publishing Company.

Course Code: MBD C403

Course Title: METHODS IN BIOSTATISTICS I

Credit: 2
(Lecture: 1, Tutorial: 1)

Hours: 30

COURSE OUTCOMES:

- Learn the basic concepts of Biostatistics.
- Understand types of data and summarizing data.
- Understand basic concept of probability and sampling distributions.
- Learn basic concepts of statistical inference.
- Understand statistical methods.

COURSE CONTENT:

Introduction

Definition and objectives of biostatistics

Types of data

Categorical data; numerical data; censored data

Summarizing data

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

Probability concepts and distributions

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

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.

Basic concepts of statistical inference

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

Goodness of fit and contingency tables

Non-parametric methods

Statistical methods

Correlation; linear regression; analysis of variance

READING LIST:

Altman, D. G. (2006). *Practical statistics for medical research*. Chapman and Hall.

Bonita, R., Beaglehole, R., & Kjellstrom, T. (2006). *Basic epidemiology* (2nd ed.).

Mood, A. M., Graybill, F. A., & Boes, D. C. (2007). *Introduction to the theory of statistics* (3rd ed.). McGraw-Hill.

Rosner, B. (2006). *Fundamentals of biostatistics* (6th ed.).

Zar, C. Z. (2015). *Biostatistical analysis* (5th ed.).

Course Code: MBD C404

Course Title: SAMPLE SURVEY DESIGNS

Credit: 2
(Lecture: 2)

Hours: 30

COURSE OUTCOMES:

- Gain understanding of basic concepts related to sample surveys with specific references to health and demographic surveys.
- Gain understanding of basic sample survey designs.
- Learn skills to design and implement sample surveys in keeping with research objectives.

COURSE CONTENT:

Concept of sampling:

Concept of population and sample, need for sampling, sample survey verses census, elementary units, sampling units, assumptions of sampling from finite population, sampling frame, selection and inclusion probabilities, concept of sampling mechanism and sampling design. Types of sampling methods, Probability sampling designs, Nonprobability sampling designs

Sample size computation

Sample size calculations using estimation targets based on relative standard error, margin of error, and power requirements

Simple Random Sampling with and without replacement

Estimation of population means and totals; Sampling error and variance estimation

Stratified Sampling

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

Systematic random sampling:

Concept of systematic sampling, comparison with simple random sampling, variance estimation, comparison with stratified random sampling, systematic sampling, selection procedure for fractional interval, circular systematic sampling; advantages and disadvantages of systematic sampling

Cluster Sampling

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

READING LIST:

Cochran, W. G. (1977). *Sampling techniques* (3rd ed.). John Wiley & Sons.

Damico, A. (n.d.). *Step-by-step instructions to analyze major public-use survey data sets with the R language*.

Des Raj. (1972). *The design of sample surveys*. McGraw Hill.

Fares, Q. (n.d.). *Sampling methods using STATA*.

Kish, L. (1995). *Survey sampling*. John Wiley & Sons.

Ladusingh, L. (2018). *Survey sampling methods*. PHI Learning.

Lohr, S. L. (1999). *Sampling: Design and analysis*. Duxbury Press.

Lumley, T. (n.d.). *Complex surveys: A guide to analysis using R*.

Murthy, M. N. (1977). *Sampling theory and methods* (2nd ed.). Statistical Publishing Society.

Roy, T. K., Acharya, R., & Roy, A. K. (2016). *Statistical survey design and evaluating impact*. Cambridge University Press.

Sukhatme, P. V., & Sukhatme, B. V. (1970). *Sampling theory of surveys with applications*. Asia Publishing.

Course Code: MBD C405

Course Title: BASIC CONCEPTS AND APPLICATION OF EPIDEMIOLOGY

Credit: 2 **Hours: 30**
(Lecture: 1, Tutorial: 1)

COURSE OUTCOMES:

- Learn the basic concepts of different streams of Epidemiology, measuring the occurrence of disease, and disease risks.
- Understand the study designs widely used in Epidemiology.
- Learn the application of Epidemiology for evaluating health services.

COURSE CONTENT:

Introduction

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

Measuring the occurrence of disease

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

Issues in epidemiology

Association; causation; causal inference; errors and bias; confounding; controlling confounding; interactions; generalizability, Hill's criteria for causation

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 approximating the RR; odds ratio from matched case-control data

An introduction to epidemiological study designs

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

Prevention of a disease

Definitions and measures: primordial prevention, primary prevention, secondary prevention, tertiary prevention, Health care services: health care systems, type of care and exposure factors.

READING LIST:

Bonita, R., Beaglehole, R., & Kjellstrom, T. (2006). *Basic epidemiology* (2nd ed.). World Health Organization.

Dunn, G., & Everitt, B. (1995). *Clinical biostatistics: An introduction to evidence-based medicine*. Edward Arnold.

Gordis, L. (2004). *Epidemiology* (3rd ed.).

MacMahon, B., & Pugh, T. F. (1970). *Epidemiology: Principles and methods*. Little Brown.

Park, K. (2021). *Park's textbook of preventive and social medicine* (26th ed.). M/S Banarsidas Bhanot Publishers.

Course Code: MBD E401

Course Title: PROGRAMMING WITH R

Credit: 2
(Lecture: 1, Practical: 1)

Hours: 45

COURSE OUTCOMES:

- Learn open source softwares R and Python for data analysis.
- Learn exploratory data analysis with R and Python.
- Learn use of R and Python programming for model development.

COURSE CONTENT:

R: Introduction

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

Importing dataset

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

Data Visualization

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

Data manipulation

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

Exploratory data analysis

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

Model development

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

READING LIST:

Christian Kleiber, & Zeileis, A. (2008). *Applied econometrics with R*. Springer-Verlag.

James, G., Witten, D., Hastie, T., & Tibshirani, R. (2013). *Introduction to statistical learning with applications in R*. Springer. Available free online.

RStudio. (n.d.). *Download RStudio*. https://www.rstudio.com

The Comprehensive R Archive Network (CRAN). (n.d.). *Download and install R*. https://cran.r-project.org

Video Tutorials for Installing R on Mac. (n.d.).

Video Tutorials on Installing R on Windows. (n.d.).

Course Code: MBD E402

Course Title: DATA ANALYSIS WITH STATA

Credit: 2 **Hours: 45**
(Lecture: 1, Practical: 1)

COURSE OUTCOMES:

- Familiarity with STATA for data analysis.
- Learn model development in STATA.
- Learn use of STATA for survey data analysis.

COURSE CONTENT:

Introduction to STATA

Facilities, creating database structure, data entry, specifying scales, validation of data entry, importing and exporting data.

Importing dataset

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

Data visualization

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

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

Exploratory data analysis

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

Model development

Linear regression analysis - interpretation and regression diagnostic test; regression models for

binary outcomes, categorical, and ordinal outcomes

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

READING LIST:

StataCorp. (2021). *STATA user's guide, release 17*. StataCorp LLC.

StataCorp. (2021). *STATA survey data reference manual, release 17*. StataCorp LLC.

SEMESTER II

Course Code: MBD F403

Course Title: INTRODUCTION TO DEMOGRAPHIC PACKAGES

Credit: 2
(Lecture: 1, Tutorial: 1)

Hours: 30

COURSE OUTCOMES:

- Gain understanding of demographic packages.
- Capable of estimating demographic outcomes using these packages.
- Capable of projecting demographic and health parameters using these packages.

CONTENT:

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.

MORTPAK modules and their application

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

Introduction and application of SPECTRUM

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

READING LIST:

Futures Institute. (n.d.). *SPECTRUM manual: Spectrum system of policy models*. Futures Institute.

United Nations. (2013). *MORTPAK for Windows*. United Nations.

Course Code: MBD C501

Course Title: INFECTIOUS DISEASE EPIDEMIOLOGY

Credit: 2
(Lecture: 2)

Hours: 30

COURSE OUTCOMES:

- Learn terms and concepts of infectious disease epidemiology.
- Learn concepts and methods related to modelling of infectious diseases.
- Learn concepts, principles, and uses of surveillance of infectious diseases.
- Familiarity with history and implications of infectious diseases.

COURSE CONTENT:

Introduction and basic concepts

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

Spread of infectious diseases and determinants

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

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.

Surveillance of infectious diseases

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

History, implications and health care responses to a pandemic

Examples of COVID-19, SARS, etc.

READING LIST:

Abubaker, I., Stagg, H. R., Cohen, T., & Rodrigues, L. C. (2016). *Infectious disease epidemiology*. Oxford University Press.

Centers for Disease Control and Prevention (CDC). (2014). *Introduction to public health*. In *Public health 101 series*. U.S. Department of Health and Human Services, CDC.

Giesecke, J. (2017). *Modern infectious disease epidemiology* (3rd ed.). CRC Press.

Gordis, L. (2004). *Epidemiology* (3rd ed.).

Kramer, A., Kretzschmar, M., & Krickeberg, K. (2012). *Modern infectious disease epidemiology: Concepts, methods, mathematical models, and public health*. Springer.

Park, K. (2021). *Park's textbook of preventive and social medicine* (26th ed.). M/S Banarsidas Bhanot Publishers.

Course Code: MBD C502

Course Title: METHODS IN BIOSTATISTICS II

Credit: 2
(Lecture: 2)

Hours: 30

COURSE OUTCOMES:

- Understand multivariable regression models and related concepts.
- Understand the use and interpretation of outputs of multivariable regression models.
- Understand other multivariate techniques.

COURSE CONTENT:

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

Multivariable regression with categorical outcome variables

Binary logistic regression; conditional logistics regression; multinomial logistic regression

Multivariable regression with ordinal and count outcome variables

Ordinal logistic regression; poisson regression

READING LIST:

Agresti, A. (2002). *Categorical data analysis*. Wiley.

Breslow, N. E., & Day, N. E. (1980). *Statistical methods in cancer research: Vol. I. The analysis of case-control studies* (IARC Scientific Publication No. 32). International Agency for Research on Cancer.

Cameron, A. C., & Trivedi, P. K. (1998). *Regression analysis of count data*. Cambridge University Press.

Gujarati, D. N., & Sangeetha. (2007). *Basic econometrics* (4th ed.). Tata McGraw-Hill.

Kennedy, P. (2008). *A guide to econometrics* (6th ed.). Wiley-Blackwell.

Retherford, R. D., & Choe, M. K. (1993). *Statistical models for causal analysis*. Wiley-Interscience Publications.

Course Code: MBD C503

Course Title: HEALTHCARE SYSTEMS AND POLICIES

Credit: 2
(Lecture: 1, Tutorial: 1)

Hours: 30

COURSE OUTCOMES:

- Become aware about the basic concepts of health/health services/health care.
- Understand health systems and services.
- Understand health policy and its formulation.
- Understand the regulations in the health sector.

COURSE CONTENT:

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

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.

Health Services

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

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

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.

Health policymaking in India

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

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.

READING LIST:

Abel-Smith, B. (2018). *An introduction to health: Policy, planning, and financing*. Routledge.

Balarajan, Y., Selvaraj, S., & Subramanian, S. V. (2011). Health care and equity in India. *The Lancet, 377*(9764), 505-515. https://doi.org/10.1016/S0140-6736(10)62039-7

Gilson, L., & World Health Organization. (2013). *Health policy and system research: A methodology reader: The abridged version*. World Health Organization.

Government of India. (2017). *National health policy-2017*. Ministry of Health and Family Welfare, Government of India.

Murray, C. J. L., & Evans, D. B. (2003). Health systems performance assessment: Goals, framework, and overview. In *Health systems performance assessment: Debates, methods, and empiricism* (pp. 3-23). World Health Organization.

Murray, C. J. L., & Frenk, J. (2000). A framework for assessing the performance of health systems. *Bulletin of the World Health Organization, 78*, 717-731.

Nandraj, S., Gupta, P., & Randhawa, S. (2021). *Regulation of health care delivery in India: A landscape study*. Health Systems Transformation Platform.

Rao, K. S. (2016). *Do we care?: India's health system*. Oxford University Press.

Course Code: MBD C504

Course Title: DEMOGRAPHIC THEORIES AND NUPTIALITY

Credit: 2
(Lecture: 1, Tutorial: 1) **Hours: 30**

COURSE OUTCOMES:

- Learn fertility theories.
- Learn framework of child survival.
- Learn basic concepts of nuptiality.
- Identify the different sources of data for nuptiality.
- Perform nuptiality analysis

COURSE CONTENT:

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.

Mosley & Chen framework of child survival

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

READING LIST:

Bogue, D. J., Arriaga, E. E., & Anderson, D. L. (Eds.). (1993). *Readings in population research methodology* (Vol. 3: Fertility research). United Nations Population Fund.

Bhende, A. A., & Kanitkar, T. (2003). *Principles of population studies* (16th ed.). Himalaya Publishing House.

Coale, A. J., & Trussell, T. J. (1978). Technical note: Finding the two parameters that specify a model schedule of marital fertility. *Population Index, 44*(2), 203-213.

Mosley, W. H., & Chen, L. C. (1984). An analytical framework for the study of child survival in developing countries. *Population and Development Review, 10*, 25-45.

Newell, C. (1988). *Methods and models in demography*. Frances Pinter.

Palmore, J. A., & Gardner, R. W. (1983). *Measuring mortality, fertility, and natural increase: A self-teaching guide to elementary measures*. East-West Population Institute, East-West Center.

Pathak, K. B., & Ram, F. (1998). *Techniques of demographic analysis* (Ch. 4, pp. 108-153). Himalaya Publishing House.

Pollard, A. H., Yusuf, F., & Pollard, G. N. (1990). *Demographic techniques* (3rd ed.). Pergamon Press.

Rowland, D. T. (2006). *Demographic methods and concepts*. Oxford University Press.

Siegel, J. S., & Swanson, D. A. (Eds.). (2004). *The methods and materials of demography* (2nd ed.). Elsevier Academic Press.

Course Code: MBD C505

Course Title: ADVANCED SAMPLE SURVEY DESIGNS

Credit: 2 **Hours: 30**
(Lecture: 2)

COURSE OUTCOMES:

- Gain understanding of complex sample survey designs.
- Know and appreciate the sampling design of large-scale surveys conducted in India.
- Learn estimation of sampling errors in large-scale surveys
- Become aware about the concept of sampling weights and estimation and application of sampling weights in large-scale surveys.

COURSE CONTENT:

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.

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

Examples of sampling design of large-scale surveys

National Family Health Survey; Longitudinal Ageing Study in India; Sample registration System; National Sample Survey Organization Surveys

Sampling weight and estimation of sampling errors

Description; computation of sampling weight under different designs; self-weighting

designs; post-stratification, Taylor series linearization method

Non-sampling errors

Introduction; coverage error; non-response error; response error

READING LIST:

Cochran, W. G. (1977). *Sampling technique* (3rd ed.). John Wiley & Sons.

Kish, L. (1995). *Survey sampling*. John Wiley & Sons.

Ladusingh, L. (2018). *Survey sampling methods*. Prentice Hall India.

Roy, T. K., Acharya, R., & Roy, A. K. (2016). *Statistical survey design and evaluating impact*. Cambridge University Press.

United Nations. (2005). *Household sample surveys in developing and transition countries*. United Nations.

Course Code: MBD C506

Course Title: SURVIVAL ANALYSIS

Credit: 3 **Hours: 45**
(Lecture: 2, Tutorial: 1)

COURSE OUTCOMES:

- Learn basic premises of survival analysis and its application.
- Learn application of non-parametric methods for estimating survival functions and differentiation of survival curves.
- Learn frequently used regression models of survival analysis.

COURSE CONTENT:

Introduction

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

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.

Survival distributions

Weibull distribution; exponential distribution; lognormal distribution; gamma distribution.

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.

Comparing survival curves

Generalized Wilcoxon (Breslow, Gehan); Logrank test.

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 hazard models in Epidemiology and Public Health; discrete-time survival models; regression models with time dependence; competing risks.

READING LIST:

Altman, D. G. (2006). *Practical statistics for medical research*. Chapman and Hall.

Armitage, P., & Berry, G. (2001). *Statistical methods in medical research* (4th ed.). Wiley Blackwell.

Choe, M. K., & Retherford, R. D. (1993). *Statistical models for causal analysis*. Wiley-Interscience.

Lee, E. T. (2003). *Statistical methods for survival data analysis* (2nd ed.). John Wiley & Sons.

Course Code: MBD E501

Course Title: LARGE-SCALE SAMPLE SURVEYS

Credit: 2
(Lecture: 1, Tutorial: 1)

Hours: 30

COURSE OUTCOMES:

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

COURSE CONTENT:

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.

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.

Quality assurance procedures

Revisit of sub-samples; field check tables; non-response pattern; roles of supervisors, editors,

field and nodal agencies; third party audit.

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.

Ethical considerations in large-scale sample surveys

Estimation of sampling weights

READING LIST:

CSPro Software. (n.d.). Retrieved from www.census.gov/data/software/cspro.Download.htm

Kish, L. (1995). *Survey sampling*. John Wiley & Sons, Inc.

Ladusingh, L. (2018). *Survey sampling methods*. PHI Learning.

Lohr, S. L. (1999). *Sampling: Design and analysis*. Duxbury Press.

Roy, T. K., Acharya, R., & Roy, A. K. (2016). *Statistical survey design and evaluating impact*. Cambridge University Press.

United Nations. (2005). *Household sample surveys in developing and transition countries*. Retrieved from www.unstats.un.org/unsd/hhsurveys/

Course Code: MBD E502

Course Title: SPATIAL ANALYTICS

Credit: 2 **Hours: 45**
(Lecture: 1, Practical: 1)

COURSE OUTCOMES:

- Learn basic spatial concepts and cartography.
- Learn basic spatial statistics.
- Learn spatial regression models and their application.
- Learn software used for estimating spatial statistics.
- Learn application of spatial statistics using ArcGIS and Geoda.

COURSE CONTENT:

Introduction to spatial statistics

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

Basic Spatial Statistics

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

Spatial Regression Models

Lag and error regressions; multilevel models; geographically weighted regression

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

Application of spatial statistics using ArcGIS and Geoda

READING LIST:

Anselin, L. (2005). *Exploring spatial data with GeoDa: A workbook*. UC Santa Barbara, CA: Center for Spatially Integrated Social Science. Available at http://geodacenter.asu.edu/.

Bailey, T., & Gatrell, A. C. (1995). *Interactive spatial data analysis*. Harlow: Longman.

ESRI. (1993). *Understanding GIS*. Redlands, USA.

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.

Sparks, C. (2013). Spatial analysis in R: Part 1. *Spatial Demography, 1*(1), 131–139.

Sparks, C. (2013). Spatial analysis in R: Part 2. *Spatial Demography, 1*(2), 219–226.

Zhu, E. J., & Chi, G. (2008). Spatial regression models for demographic analysis. *Population Research and Policy Review, 27*, 17–42. https://doi.org/10.1007/s11113-007-9051-8

Course Code: MBD E503

Course Title: PROGRAMMING FOR DATA ANALYSIS WITH PYTHON

Credit: 2 **Hours: 45**
(Lecture: 1, Practical: 1)

COURSE OUTCOMES:

- Learn open source software Python for data analysis.
- Learn exploratory data analysis with Python.
- Learn use of Python programming for model development.

COURSE CONTENT:

Introduction

Introduction to Python; Advantages of python over other programming languages, various Python IDEs, Sequence data types and associated operations, List, Dictionaries, Regular Expressions, Conditions and loops, Python packages for data science, File handling (Reading and Writing Files, Organizing Files).

Data access and preparation

Understanding ndarrays: a multidimensional array object, creating ndarrays, data types for ndarrays, array arithmetic and element wise operation, basic indexing and slicing, reshaping and transposing arrays, universal functions: fast element-wise array functions, file input and output with arrays, introduction to pandas data structures, series, data frame.

Data import and export, indexing, filtering, and sorting data, handling missing data, string manipulation, data wrangling: merging, joining, reshaping data.

Exploratory data analysis

Descriptive analysis (Measures of central tendency, dispersion/variation, measure of location), computation of correlation coefficient, chi-square test for association between two categorical variables.

Data visualization

Basic libraries for data visualization. Introduction to Matplotlib, Basic plots using matplotlib, Specialized Visualization Tools using Matplotlib, *Seaborn:* Seaborn functionalities and usage

Model development

Introduction to modeling libraries in python, introduction to statsmodels, scikit-learn.

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

READING LIST:

Johansson, R. (2019). Numerical Python: Scientific computing and data science applications with NumPy, SciPy, and Matplotlib. Apress.

Madhavan, S. (2015). Mastering Python for data science. Packt Publishing.

McKinney, W. (2017). Python for data analysis. O'Reilly Media.

Pine, D. J. (2019). Introduction to Python for science and engineering. CRC Press.

Taieb, D. (2018). Data analysis with Python: A modern approach. Packt Publishing.

VanderPlas, J. (2017). Python data science handbook: Essential tools for working with data. O'Reilly Media.

Course Code: MBD E511

Course Title: URBANIZATION, SPACE AND PLANNING

Credit: 3
(Lecture: 2, Tutorial: 1)

Hours: 45

COURSE OUTCOMES:

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

COURSE CONTENT:

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

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 centers in rural development.

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 of urban planning; types of urban plans: New towns, neighborhood, garden city, green belts; healthy urban planning, WHO concept of healthy city, livable city, sustainable city.

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

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)

Remote Sensing, GIS and Urban and Regional Planning

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

READING LIST:

Bhagat, R. B., Roy, A. K., & Sahoo, S. (2020). *Migration and urban transition in India: A development perspective*. Routledge India.

Chand, M., & Puri, V. K. (1983). *Regional planning in India*. Allied Publishers Private Ltd.

Chaudhuri, J. R. (2001). *An introduction to development and regional planning*. Orient Longman.

Friedman, J. (1966). *Regional development policy: A case study of Venezuela*. MIT Press.

Friedman, J., & Alonso, W. (1964). *Regional development and planning: A reader*. The MIT Press.

Friedman, J., & Weaver, C. (1979). *Territory and function: The evolution of regional planning*. Edward Arnold.

Ginsburg, N., Koppel, B., & McGee, T. G. (1991). *The extended metropolis: Settlement transition in Asia*. University of Hawaii Press.

Hall, P. (1992). *Urban and regional planning* (3rd ed.). Routledge.

Harvey, D. (2012). *Rebel cities: From the right to the city to the urban revolution*. Verso.

Husain, M. (1994). *Human geography*. Rawat Publishing.

Kawashima, T., & Korcelli, P. (1982). *Human settlement systems: Spatial patterns and trends*. IIASA.

Knowles, R., & Warling, J. (1983). *Economic and social geography: Made simple*. Heinemann.

Kumar, A., & Bhagat, R. B. (2021). *Migrants, mobility and citizenship in India*. Routledge India.

Leong, G. C., & Morgan, G. C. (1982). *Human and economic geography*. Oxford University Press.

Lo, C. P., & Yeung, A. K. W. (2002). *Concepts and techniques of geographic information systems*. Prentice Hall of India.

Mishra, R. P. (1992). *Regional planning: Concepts, techniques, policies and case studies*. Concept Publishing Co.

MMRDA. (2016). *Mumbai Metropolitan Regional Development Plan 2016-2036*. MMRDA.

Nath, V. (1971). "Regional development policies." *Economic and Political Weekly, 6*(30-32), 1601-1608.

Nyerges, T. L., & Jankowski, P. (2010). *Regional and urban GIS: A decision support approach*. Rawat Publication.

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.

Sarin, M. (1982). *Urban planning in the Third World: The Chandigarh experience*. Manshell.

Singh, R. Y. (1994). *Geography of settlements*. Rawat Publications.

UNEP, & others. (2007). *Livable cities: The benefits of environmental planning*. The Cities Alliance. http://www.citiesalliance.org/index.html

Zhu, E. J., & Chi, G. (2008). Spatial regression models for demographic analysis. *Population Research and Policy Review, 27*, 17–42. https://doi.org/10.1007/s11113-007-9051-8

SEMESTER III

Course Code: IKS 501

Course Title: INDIAN KNOWLEDGE SYSTEM-2

Credit: 02
(Lecture: 2)

Hours: 30

Under process

Course Code: MBD C507

Course Title: RESEARCH METHODOLOGY

Credit: 2
(Lecture: 1, Tutorial: 1)

Hours: 30

COURSE OUTCOMES:

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

COURSE CONTENT:

Philosophy of Research

Scientific Methods of Research

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

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

Clinical agreement

Kappa statistics

Research Ethics

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

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

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

Data Collection and processing

Analysis of qualitative data using softwares

Nvivo; ATLAS Ti; Dedoose

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

READING LIST:

Creswell, J. W. (2007). *Qualitative inquiry and research design: Choosing among five approaches* (2nd ed.). Sage Publications.

Dunn, G., & Everitt, B. (1995). *Clinical biostatistics: An introduction to evidence-based medicine*. Edward Arnold.

Given, L. M. (2008). *The SAGE encyclopedia of qualitative research methods*. SAGE

Publications Inc.

Indian Council of Medical Research (ICMR). (2017). *National ethical guidelines for biomedical and health research involving human participants*. ICMR New Delhi.

Schensul, S. L., Schensul, J. J., & LeCompte, M. D. (1999). *Essential ethnographic methods: Observations, interviews, and questionnaires*. Altamira Press.

United Nations. (2005). *Household sample surveys in developing and transition countries*. Department of Economics and Social Affairs, United Nations.

Wolf, C., Joye, D., Smith, T. W., & Fu, Y. (2016). *The SAGE handbook of survey methodology*. SAGE Reference.

Course Code: MBD C508

Course Title: ADVANCED DEMOGRAPHIC METHODS

Credit: 2 **Hours: 30**

(Lecture: 1, Tutorial: 1)

COURSE OUTCOMES:

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

COURSE CONTENT:

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.

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 and migration components; population projections of United Nations and Expert Committee, Government 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.

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.

READING LIST:

Government of India. (2006). *Population projections for India and states, 2001–2026*. Office of the Registrar General.

Moultrie, T., Dorrington, R., Hill, A., Hill, K., Timæus, I., & Zaba, B. (2013). *Tools of demographic estimation*. IUSSP.

Preston, S. H., Heuveline, P., & Guillot, M. (2001). *Demography: Measuring and modeling population processes*. Blackwell Publishers Ltd.

Shryock, H. S., & Siegel, J. S. (1976). *The methods and materials of demography*. Academic Press, Inc.

Srinivasan, K. (1997). *Basic demographic techniques and applications*. SAGE.

United Nations. (1956). *Manual III: Methods for population projections by age and sex*. United Nations.

Course Code: MBD C509

Course Title: ADVANCED METHODS IN BIOSTATISTICS

Credit: 2 **Hours: 30**

(Lecture: 2)

COURSE OUTCOMES:

- Become aware about the advanced multivariate models.
- Capable of estimating and interpreting advanced multivariate models.
- Capable of estimating and interpreting multilevel models.
- Learn other multivariate techniques

COURSE CONTENT:

Simultaneous equation models

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

Generalized linear models

A general model for the response probability; the logit, the probit and the complementary log –log model; choice of link function; estimation of generalized model; latent variable representation of a generalized linear model.

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.

Other multivariate techniques

Factor analysis; discriminant analysis; cluster analysis.

READING LIST:

Backhaus, K., Erichson, B., Gensler, S., Weiber, R., & Weiber, T. (2021). *Multivariate*

analysis: An application-oriented introduction. Springer Gabler Wiesbaden.

Dobson, A. J., & Barnett, A. (2008). *An introduction to generalized linear models*. Chapman and Hall.

Goldstein, H. (2003). *Multilevel statistical models* (3rd ed.). Arnold.

Gujarati, D. N., & Sangeetha. (2007). *Basic econometrics* (4th ed.). Tata McGraw Hill.

Hair, J. F., Jr., Black, W. C., Babin, B. J., & Anderson, R. E. (2009). *Multivariate data analysis* (7th ed.). Pearson.

McCullagh, P., & Nelder, J. A. (1989). *Generalized linear models*. CRC Press.

Snijders, T. A. B., & Bosker, R. J. (1999). *Multilevel analysis: An introduction to basic and advanced multilevel modeling*. Sage Publications.

Course Code: MBD C510

Course Title: DATA MANAGEMENT AND ANALYSIS IN SAS

Credit: 2 **Hours: 45**

(Lecture: 1, Practical:1)

COURSE OUTCOMES:

- Learn the functioning of the SAS statistical packages in handling data sets.
- Learn data wrangling in SAS.
- Learn data analysis in SAS.
- Learn the survey data analysis module in SAS.

COURSE CONTENT:

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.

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.

Estimation of measures of central tendency and dispersion

Analysis of variance and covariance

One sample test; two-sample tests; one-way analysis of variance; two- and N- way analysis of variance; analysis of covariance

Linear regression analysis and regression diagnostics

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

Regression models for survival data analysis

Cox proportional hazard model; test for proportionality assumption; discrete-time survival models

Event-count models

Poisson regression; generalized linear models

Survey data analysis

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

READING LIST:

Cody, R., & Smith, J. (1997). *Applied statistics & the SAS programming language* (4th ed.). Prentice Hall.

Field, A., & Miles, J. (2010). *Discovering statistics using SAS*. SAGE Publishing.

Course Code: MBD C511

Course Title: DEMOGRAPHIC MODEL AND INDIRECT METHODS OF ESTIMATION

Credit: 2 **Hours: 30**

(Lecture: 1, Tutorial:1)

COURSE OUTCOMES:

- Learn and appreciate the concept of demographic modelling of events, processes, and outcomes.
- Familiarity with indirect estimation procedures of vital rates towards verifying its robustness with observed survey estimates.
- Learn the limitation in available data and service statistics as regards its completeness, accuracy, and reliability.

COURSE CONTENT:

Concepts of demographic models

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

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.

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 and surviving mothers classified by current age of mother; modifications proposed by 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.

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.

READING LIST:

Bhat, P. N. M. (2002). Completeness of India's Sample Registration System: An assessment using the general growth balance method. *Population Studies, 56*(2), 119–134.

Bhat, P. N. M. (2002). General growth balance method: A reformulation for population open to migration. *Population Studies, 56*(1), 23–34.

Keyfitz, N. (1977). *Introduction to the mathematics of population with revision*. Addison-Wesley Publishing Company, Inc.

Moultrie, T., Dorrington, R., Hill, A., Hill, K., Timæus, I., & Zaba, B. (2013). *Tools of demographic estimation*. IUSSP.

Pathak, K. B., & Ram, F. (1998). *Techniques of demographic analysis* (2nd ed.). Himalaya Publishing House.

Preston, S. H., Heuveline, P., & Guillot, M. (2003). *Demography: Measuring and modeling population processes* (First Indian Reprint). Blackwell Publishers.

United Nations. (1983). *Indirect techniques for demographic estimations* (Manual X, Population Studies No. 81). Department of International Economic and Social Affairs.

Course Code: MBD E521

Course Title: CONCEPTS AND MEASURES OF GLOBAL HEALTH

Credit: 3 **Hours: 45**

(Lecture: 2, Tutorial:1)

COURSE OUTCOMES:

- Learn basic concepts and importance of global health.
- Learn the basic concepts and methods used for studying global burden of disease.
- Learn determinants of health.
- Learn functioning of health care delivery system.

COURSE CONTENT:

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.

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.

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.

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.

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.

READING LIST:

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). Retrieved from https://www.cfr.org/sites/default/files/report_pdf/TFR72_NCDs.pdf

Dielman, J. L., Schneider, M. T., 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. *The Lancet, 387*, 2536–2544.

Fried, L. P., Bentley, M. E., Buekens, P., Burke, D. S., Frenk, J. J., & Klag, M. J. (2010). Global health is public health. *The Lancet, 375*, 535–537.

Hoffmann, S. J. (2010). The evolution, etiology, and eventualities of the global health security regime. *Health Policy and Planning, 25*(6), 510–522. Retrieved from

https://www.ncbi.nlm.nih.gov/pubmed/20732860

Hsiao, W. C. (2003). What is a health system? Why should we care? *Harvard School of Public Health Working Paper*.

Mills, A., Rasheed, F., & Tollman, S. (2006). Strengthening health systems. In *Disease control priorities in developing countries* (2nd ed., pp. 87–102). Oxford University Press.

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), 26–28.

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.

Murray, C. J. L., Saloman, J. A., & Mathers, C. D. (2000). A critical examination of summary measures of population health. *Bulletin of the World Health Organization, 78*(8), 981–994.

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.

Skolnik, R. (2008). *Essentials of global health*. Jones and Bartlett.

World Health Organization. (2010). *Key components of a well-functioning health system*. Retrieved from http://www.who.int/healthsystems/publications/hss_key/en/

World Health Organization. (2017). *Double burden of malnutrition*. Retrieved from http://www.who.int/nutrition/double-burden-malnutrition/en/

Course Code: MBD E522

Course Title: ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING APPLICATIONS

Credit: 3 **Hours: 45**

(Lecture: 2, Tutorial:1)

To provide conceptual knowledge and applications of AI and ML.

COURSE OUTCOMES:

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

COURSE CONTENT:

Basic concepts of Big Data

Concept of Big Data, 5Vs, Data Science, Machine Learning (ML), Deep learning (DS), Artificial Intelligence (AI). Survey data vs. digital data – advantages and disadvantages

Application of AI

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

Relational Database Management Systems

SQLite with R, MariaDB with R on amazon EC2 instance, PostgreSQL with R on amazon RDS.

Digital trace data and cloud computing

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

Machine Learning

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

Models in machine learning

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

READING LIST:

Alpaydin, E. (2005). *Introduction to machine learning*. PHI.

Burger, S. V. (2018). *Introduction to machine learning with R: Rigorous mathematical modeling*. O'Reilly.

Doss, A. (2013). *Cloud computing*. Tata McGraw Hill.

Lantz, B. (2019). *Machine learning with R: Expert techniques for predictive modeling* (3rd ed.). Packt Publications.

Lewis, N. D. (2017). *Machine learning made easy with R: An intuitive step-by-step blueprint for beginners*. CreateSpace Independent Publishing Platform.

Mitchell, T. (1997). *Machine learning*. McGraw Hill.

Ng, A. (n.d.). *Machine learning yearning*. Retrieved from https://nessie.ilab.sztaki.hu/~kornai/2020/AdvancedMachineLearning/Ng_MachineLearningYearning.pdf

Rittinghouse, J. W., & Ransome, F. (2009). *Cloud computing: Implementation, management and security*. CRC Press.

Russell, S., & Norvig, P. (2010). *Artificial intelligence: A modern approach* (3rd ed.). Prentice Hall.

Vecciola, B., & Selvi. (2017). *Mastering cloud computing: Foundations and applications programming*. Tata McGraw Hill.

Course Code: MBD E523

Course Title: HEALTH ECONOMICS AND FINANCING

Credit: 3 **Hours: 45**

(Lecture: 2, Tutorial:1)

COURSE OUTCOMES:

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

COURSE CONTENT:

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.

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.

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

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

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

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

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.

READING LIST:

Culyer, A. J., & Newhouse, J. P. (2000). The state and scope of health economics. In A. J. Culyer & J. P. Newhouse (Eds.), *Handbook of health economics* (Vol. 1A). Elsevier.

Drummond, M. F., Sculpher, M. J., Torrance, G. W., O'Brien, B., & Stoddart, G. L.

(Eds.). (2005). *Methods for economic evaluation of health care programmes* (3rd ed.). Oxford University Press.

Grossman, M. (1982). On the concept of health capital and demand for health. *Journal of Political Economy, 80*(2).

Macintyre, S. (1997). The Black Report and beyond—What are the issues? *Social Science & Medicine, 44*(6), 723–745.

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.

O'Donnell, O., van Doorslaer, E., Wagstaff, A., & Lindelow, M. (2008). *Analyzing health equity using household survey data: A guide to techniques and their implementation*.

Ringel, J. S., Hosek, S. D., Vollaard, B. A., & Mahnovski, S. (2005). *The elasticity of demand for health care: A review of the literature and its application to the military health system*. RAND Corporation.

Rexford, E. S., & Neun, S. P. (2007). *Health economics: Theories, insights, and industry studies* (4th ed.). Thompson South-Western.

Victoria, Y. F., & Savedoff, W. D. (2014). Health financing transition: A conceptual framework and empirical evidence. *Social Science & Medicine, 105*, 112–121.

Wagstaff, A., Paci, P., & van Doorslaer, E. (1991). On the measurement of inequalities in health. *Social Science & Medicine, 33*(5), 545–557.

Wagstaff, A., & van Doorslaer, E. (2000). Equity in health care finance and delivery. In A. J. Culyer & J. P. Newhouse (Eds.), *Handbook of health economics* (Vol. 1, Ch. 34, pp. 1803–1862). Elsevier.

World Health Organization. (2005). *Distribution of health payments and catastrophic expenditures: Methodology*. WHO.

Course Code: MBD E524

Course Title: MONITORING AND EVALUATION IN POPULATION AND HEALTH

Credit: 3 **Hours: 45**

(Lecture: 2, Tutorial:1)

COURSE OUTCOMES:

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

COURSE CONTENT:

Introduction to monitoring and evaluation

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

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

Monitoring of policy implementation

Components of policy and programme, budget, staff, process of evaluation, developing

tangible indicators for policy monitoring in terms of input, process, output, outcome, impact; result based inference

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

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.

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

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

Management information system and use of technology

MIS – monitoring information system; role of programmers; HMIS system; global positioning system; Use of machine learning and artificial intelligence, use of spatial data

READING LIST:

Casley, D. J., & Kumar, K. (1988). *The collection, analysis, and use of monitoring and evaluation data*. A World Bank Publication, The Johns Hopkins University Press.

Family Health International. (2004). *Introduction to monitoring and evaluation: Monitoring HIV/AIDS programs—A facilitator's training guide*. Family Health International.

International Federation of Red Cross and Red Crescent Societies. (2002). *Handbook for monitoring and evaluation*. IFRC.

McLean, R., & Gargani, J. (2019). *Scaling impact: Innovations for the public good*. Routledge.

Sullivan, T. M., Strachan, M., & Timmons, B. K. (2007). *Guide to monitoring and evaluating health information products and services*. Center for Communication Programs, Johns Hopkins Bloomberg School of Public Health; Constella Futures; Management Sciences for Health.

United Nations Development Group. (n.d.). *The theory of change: UNDAF companion guideline*.

United Nations Development Programme. (2009). *Handbook on planning, monitoring, and evaluating for development results*. UNDP.

Course Code: MBD E531

Course Title: POPULATION AGEING AND HEALTH TRANSITION

Credit: 3 **Hours: 45**

(Lecture: 2, Tutorial:1)

COURSE OUTCOMES:

- Learn concepts and theoretical framework relating to demography of ageing, and its health and societal interface.
- Develop skills to analyze trends, determinants and consequences of population ageing.
- Familiarize with aging data sets and its exploration.
- Learn ageing policies and programmes and its bearing on the welfare of the elderly.

COURSE CONTENT:

Demography of ageing

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.

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

Life course perspective and social dynamics of ageing

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.

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.

Ageing and health

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

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

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

Ageing policies and programmes

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

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

READING LIST:

Alam, M. (2004). Ageing, old age income security and reforms: An exploration of the Indian situation. *Economic and Political Weekly, 39*(33), 3731–3740.

Berman, L. (2000). Social support, social networks, social cohesion and health. *Social Work in Health Care.* https://dx.doi.org/10.1300/J010v31n02_02

Chakraborti, R. D. (2004). *The greying of India: Population ageing in the context of Asia*. SAGE Publications Private Limited.

Gruescu, S. (2006). *Population ageing and economic growth*. Physica-Verlag.

Pool, I., Wong, L. R., & Vilquin, E. (Eds.). (2006). *Age-structural transitions: Challenges for development*. CIRCRED.

United Nations. (2001). *Living arrangements of older persons: Critical issues and policy responses* (Special Issue Nos. 42/43). Population Division, Department of Economic and Social Affairs.

United Nations Population Fund (UNFPA). (2001). *Population ageing and development:*

Social, health and gender issues. United Nations.

United Nations Population Fund (UNFPA). (2011). *Report on the status of elderly in select states of India*. UNFPA.

World Health Organization. (2015). *WHO report on ageing and health*. WHO.

Course Code: MBD E532

Course Title: GENDER, HEALTH AND DEVELOPMENT

Credit: 3 **Hours: 45**

(Lecture: 2, Tutorial:1)

COURSE OUTCOMES:

- To sensitize students on gendered perspectives in reading health and development outcome.
- To gain understanding of theoretical and conceptual issues involving gender in examining development at large.
- To acquaint students with varied gendered frameworks and relevant analytical tools towards gendered inspection.
- To offer skills of adopting a gendered outlook in introspecting health and development.

COURSE CONTENT:

Gender Theories

Principal theories of patriarchy: traditionalist theories of patriarchy, new economic theories of patriarchy; Historical perspectives of feminism: first, second, third and fourth wave of feminism

Gender and Health

Gender and health connections: Gender differences in health, healthcare behaviours (including health-seeking), access to and uptake of health services, treatment responses and health outcomes;

Intersectionality of gender and health: Gender as a health determinant; gender roles and power dynamics and its interaction with other power hierarchies of privilege/disadvantage resulting in inequality and differential health outcomes (age, sex, education, religion,

caste, race, ethnicity, class, language, geographical location, disability status, migration status, gender identity and sexual orientation);

Gender and morbidity and mortality: differentials in morbidity and mortality burden in the developing world and India, sex ratio of births, reproductive health of women and men in developing world, differentials in use of male and female methods of contraception; alcoholism, tobacco and drug consumption, accident, violence, risk taking;

Gender and Development

Gender dimension of social development gender differentials in household headship and role in decision making;

Gender differences in freedom of movements;

Women's role in community life: involvement in politics-as voter, political worker and leader, women in Panchayati Raj Institutions and self-help groups;

Gender and environment: climate change and its differential impact on men and women.

Gender development/equality measures: Gender Development Index (GDI), Gender Inequality Index (GII), Women, Business and Law Index, Global Gender Gap Index (GGGI); Social Institutions and Gender Index (SIGI); etc.

Gender mainstreaming in health and development programs

Gender mainstreaming: gender responsive policy making and planning of health and development programs; gender analysis of health and development programs, gender analysis tools, gender budgeting and auditing

READING LIST:

Baser, E. (1989). *Woman's role in economic development*. Earthscan.

Bhasin, K. (1993). *What is patriarchy?* Kali for Women Publishers.

Bhasin, K. (2000). *Understanding gender*. Kali for Women Publishers.

Bird, C. E., & Rege, P. (2008). *Gender and health: The effects of constrained choices and social policies*. Cambridge University Press.

Boserup, E. (1989). *Woman's role in economic development*. Earthscan.

Chodhuri, M. (Ed.). (2004). *Feminism in India: Issues in contemporary Indian feminism*. Zed Books.

Connell, R. (2012). Gender and health in theory: Conceptualizing the issue in local and world perspective. *Social Science & Medicine, 74*(11), 1675-1683.

Davis, K., Evans, M., & Judith, L. (Eds.). (2006). *Handbook of gender and women's studies*. Sage.

Engels, F., & Untermann, E. (2021). The origin of the family, private property and the state. In *Politics and Kinship* (pp. 217-223). Routledge.

Hankivsky, O. (2012). Women's health, men's health, and gender and health: Implications of intersectionality. *Social Science & Medicine, 74*(11), 1712-1720.

Hawkes, S., & Buse, K. (2013). Gender and global health: Evidence, policy and inconvenient truths. *The Lancet, 381*(9879), 1783-1787. https://doi.org/10.1016/S0140-6736(13)60253-6

John, M. E. (Ed.). (2008). *Women's studies in India: A reader*. Penguin Group.

Kabeer, N. (1994). *Reversed realities: Gender hierarchies in development thought*. Verso.

Lerner, G. (1986). *The creation of patriarchy*. University of Oxford Press.

Matud, M. P. (2017). Gender and health. In A. Alvinius (Ed.), *Gender differences in different contexts*. https://doi.org/10.5772/65410

Nagla, M. (2013). *Gender and health*. Rawat Publications.

Nichols, F. H. (2000). History of the women's health movement in the 20th century. *Journal of Obstetric, Gynaecologic & Neonatal Nursing, 29*(1), 56-64.

Rege, S. (2003). *Sociology of gender*. Sage.

Reeves, H., & Baden, S. (2000). *Gender and development: Concepts and definitions* (Report No. 55). University of Sussex: Institute of Development Studies.

Springer, K. W., Hankivsky, O., & Bates, L. M. (2012). Gender and health: Relational, intersectional, and biosocial approaches. *Social Science and Medicine, 74*(11), 1661-1666. https://doi.org/10.1016/j.socscimed.2012.03.001

Tarricone, I., & Riecher-Rössler, A. (Eds.). (2019). *Health and gender: Resilience and vulnerability factors for women's health in the contemporary society*. Springer. https://doi.org/10.1007/978-3-030-15038-9

Walby, S. (2013). *Patriarchy at work: Patriarchal and capitalist relations in employment, 1800-1984*. John Wiley & Sons.

Wilson, K. (2015). Towards a radical re-appropriation: Gender, development, and neoliberal feminism. *Development and Change, 46*(4), 803-832. https://doi.org/10.1111/dech.12176

World Bank. (2012). *World development report 2012: Gender equality and development*. World Bank.

Course Code: MBD E533

Course Title: OPERATIONS RESEARCH IN POPULATION AND HEALTH

Credit: 3 **Hours: 45**

(Lecture: 2, Tutorial:1)

COURSE OUTCOMES:

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

COURSE CONTENT:

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

Identification of problem and solution

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

Causality (Randomize Experimental Design)

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

Quasi/non-experimental design

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

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

Study design exercises

Ethics in operations research

ICMR guidelines; international perspectives; case studies

Utilization and dissemination, and process documentation

READING LIST:

Fisher, A. A., Foreit, J. R., Laing, J., Stoeckel, J., & Townsend, J. (2002). *Designing HIV/AIDS intervention studies: An operations research handbook*. Population Council.

Foreit, J. R., & Frejka, T. (1998). *Family planning operations research: A book of readings*. Population Council.

Kish, L. (1965). *Survey sampling*. John Wiley & Sons.

Course Code: MBD E534

Course Title: POPULATION, ENVIRONMENT AND SUSTAINABLE DEVELOPMENT

Credit: 3 **Hours: 45**

(Lecture: 2, Tutorial:1)

COURSE OUTCOMES:

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

COURSE CONTENT:

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.

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;

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.

READING LIST:

Bongaarts, J. (1992). Population growth and global warming. *Population and Development Review, 18*, 299–319.

Brūndtland, G. H. (1987). *Our common future: The World Commission on Environment and Development*. Oxford University Press.

Hardin, G. (1968). The tragedy of the commons. *Science, 162*(13), 1243–1248. Reprinted in R. R. Campbell & J. L. Wade (Eds.), *Society and environment: The coming collision* (pp. 1243–1248). Allyn and Bacon.

Hanley, N., Shogren, J. F., & White, B. (2007). *Environmental economics: In theory and practice*. Palgrave Macmillan.

Lutz, W., Prskawetz, A., & Sanderson, W. C. (Eds.). (2002). *Population and environment: Methods of analysis* (Supplement to *Population and Development Review*). Population Council.

Simon, J. L. (1996). *Population matters: People, resources, environment, and immigration*. Transaction Publishers.

Stern, N. (2014). *The economics of climate change: The Stern Review*. Cambridge University Press.

United Nations. (n.d.). *UN climate reports*. Retrieved from https://www.un.org/en/climatechange/reports

Van Lange, P. A. M., Rockmann, H., & Wu, J. (Eds.). (2018). *Psychology and climate change: Human perceptions, impacts, and responses*. Academic Press.

Course Code: MBD E535

Course Title: OCCUPATIONAL HEALTH

Credit: 3 **Hours: 45**

(Lecture: 2, Tutorial:1)

COURSE OUTCOMES:

- To impart knowledge to students on occupational health risks/ hazards and their demographic implications.
- To make students acquainted with the basic concepts, theories, measurements and data sources of occupational health risks/hazards.
- It enhances the understanding of different types of contemporary hazardous occupations throughout the world.
- It orients to help students in developing an in-depth understanding about the intersectionality of occupation, health and demography in low and middle-income countries.
- Familiarized with the social welfare policies and laws/ legislations/ acts for workers in India.

Teaching Strategy: Classroom teaching, seminars, case studies, group exercises and field visits.

COURSE CONTENT:

Introduction of Occupational Health and Demography

Definition, basic concepts, the scope of occupational health and importance in demography; Difference between occupational health risks and hazards; Historical development of occupational health, the intersectionality of occupational health, socioeconomic characteristics, and demography; Pre and Post industrialization theories on occupational health risks and hazards; Decent work; Women's health and safety.

Morbidity and Mortality

Health Well-being of Workers; Occupation–related Morbidity, Health Disorders, Different types of Disabilities, and Mortality; Mental Health.

Types and Measurements of Occupational Health Risks: Occupational disciplines and related risks - Mechanical, Chemical, Biological, Physical, Psychological, Medical, Ergonomic, and Work organization hazards/risks (Hazards or stressors that cause stress (short- term effects) and strain (long-term effects)); Measurements of occupational health safety, risks and hazards; Health impact assessment, Mental health assessment scale, Musculoskeletal disorder scale, American Thoracic Society and the Division of Lung Diseases (ATS-DLD-78), Occupational Stress Index (OSI), Job Strain Model, etc.

Data Sources of Occupational Health: International and National Data Sources of Occupational Health - Population Census, Services Statistics, Large - and Small-Scale Sample Surveys etc. Data limitations in the area of occupational health.

Legislation, Social and Welfare Policies: International Labour Organization (ILO) Declaration on Fundamental Principles and Rights at Work; International Labour Standards on Occupational Safety and Health, Wages and Working time; ILO - Occupational Safety and Health Convention, Health and Safety Acts; The Occupational Safety, Health and Working Conditions Code, 2020; Hazardous Waste Management Rules – 2000, Constitutional Rights, Wage Regulations (Minimum Wage Act), Factory Act – 1948, Workmen Compensation Act – 1960, Employee Provident Act – 1952, Labour Welfare Measures, Retirement Benefits/National Pension Scheme – 2004, Social Welfare Schemes and Programmes.

Occupational Health in India: History of Occupational Health in India (types of occupations, work environment and working conditions); Health behavioral risks and hazards; Evolution of labour unions; and Contemporary occupational health challenges of workers in India.

READING LIST

Alli, B. O. (2008). *Fundamental principles of occupational health and safety* (2nd ed.). International Labour Office.

Bhan, G., Chowdhury, A. R., & Mehra, R. (2021). *State of occupational safety and health practices at workplace for domestic workers in COVID-19 and possibilities for action*. International Labour Organization.

Dyck, D. E. G. (2020). *Occupational health & safety: Theory, strategy & industry practice* (4th ed.). Thomson Reuters.

Global Strategy on Occupational Health for All: The Way to Health at Work. (1994). WHO Collaborating Centres in Occupational Health.

Government of India. (2012). *Report of the working group on occupational safety and health for the twelfth five-year plan (2012 to 2017)*. Ministry of Labour and Employment.

Government of India. (n.d.). *National policy on safety, health and environment at workplace*. Ministry of Labour and Employment. Retrieved from https://labour.gov.in/policies/safety-health-and-environment-work-place

Government of India, Ministry of Rural Development. (2015). *Occupational health & safety, environmental issues and decent work—Module 8*.

International Labour Conference. (2003). *Global strategy on occupational safety and health*. International Labour Organization.

McAdams, M. T., Kerwin, J. J., Olivo, V., & Goksel, H. A. (2011). *National assessment of the occupational safety and health workforce* (200-2000-08017, Task Order 18).

Occupational safety and health in public health emergencies: A manual for protecting health workers and responders. (2018). World Health Organization & International Labour Office.

Tamin, J. (2020). *Occupational health ethics: From theory to practice*. Springer Cham. https://doi.org/10.1007/978-3-030-47283-2

World Health Organization (WHO) - Regional Office for the Eastern Mediterranean. (2001). *Occupational health: A manual for primary health care workers* (WHO-EM/OCH/85/E/L).

Course Code: MBD C512

Course Title: METHODS IN CLINICAL TRIALS

Credit: 3 **Hours: 45**

(Lecture: 2, Tutorial:1)

COURSE OUTCOMES:

- Learn features and characteristics of clinical trials and its execution.
- Learn varying designs, recruitment of clients, and various stages of clinical trials.
- Learn methods for analyzing clinical trial data.

COURSE CONTENT:

Basic concepts of clinical trials

Basic concepts; definitions; historical perspectives, Classification of trials by design and purpose: Phases of clinical trials, concept of randomization, process of randomization, types of blinding.

Clinical trial designs

Completely randomized design, randomized block designs and factorial designs; cross-over designs.

Sample size determination

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

Planning and conduct of clinical trials

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

Ethical issues

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

Data safety and monitoring concepts

Types of form for clinical trials - baseline assessment, evaluation form, flow sheet,

layout and design, missing, range and logical checks, data transfer

Analysis of data from clinical trials

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

READING LIST:

Das, M. N., & Giri, N. C. (n.d.). *Design and analysis of experiments*. Wiley Eastern.

Dean, A., & Voss, M. (n.d.). *Design and analysis of experiments*.

Everitt, B. S., & Pickels, A. (2004). *Statistical aspects of the design and analysis of clinical trials* (2nd ed.). Imperial College Press.

Federer, W. T. (n.d.). *Experimental designs: Theory and methods*. Oxford & IBH.

Friedman, L. M., Furberg, C. D., & DeMets, D. L. (1982). *Fundamentals of clinical trials*. PSG.

Pocock, S. J. (1983). *Clinical trials: A practical approach*. Wiley Medical Publications.

SEMESTER IV

Code: MBD R501

Title: RESEARCH FIELD WORK

Credit: 6 **Hours: 90**

Guideline for Research Fieldwork

The paper is of 6 credits amounting to 90 hours. The division of the hours may be as follows:

Distribution of time:

15 hours- Choosing a suitable topic, preparation and finalization of the study tools (qualitative guidelines and quantitative schedules/questionnaires) in consultation with the concerned teachers, Code of Conduct and ethical permission

5 hours- Preparation of data entry package (CS pro and other open access tools) and entry of quantitative data

35 hours- Field visit and collection of required data from community

5 hours- Preparation of qualitative transcripts

10 hours- Teaching Research Training/ oreintation of qualitative data analysis software- Atlas.ti, Anthropac and NVivo

10 hours- Preparation and presentation of the study findings

10 hours- Finalization and submission of the study/ research report (Individual as well as Group report)

Field work Instruments:

The students are suggested to conduct **IDI**, **KII** besides **observation** and **social mapping** to gather qualitative data.

For gathering quantitative data, students may use **Interview schedule** or **Questionnaire.**

Software for Qualitative Research:

ANTHROPAC, Atlast Ti and Group Work

Software for Data Collection in large scale surveys

Computer assisted personal interview (CAPI), process of data transfers, introduction to features

of Census and Survey Processing System (CSPro), steps for development of data entry software in CSPro; Web-designed questionnaires.

READING LIST:

CSPro Software. (n.d.). *CSPro software*. U.S. Census Bureau. Retrieved from www.census.gov/data/software/cspro.Download.htm

DHS Program. (n.d.). *DHS manuals*. Retrieved from https://dhsprogram.com/what-we-do/survey-operations/manuals.cfm

Longitudinal Ageing Study in India (LASI). (n.d.). *LASI manual for interviewer*.

National Family Health Survey (NFHS). (n.d.). *NFHS manual for interviewer*.

National Family Health Survey (NFHS). (n.d.). *Manual for CAPI used in NFHS*.

United Nations. (2005). *Household sample surveys in developing and transition countries*. United Nations Statistics Division. Retrieved from www.unstats.un.org/unsd/hhsurveys/

Code: MBD R511

Title: REVIEW PAPER

Credit: 3 **Hours: 60**

Systematic Review and Application of Meta-Analysis

COURSE OUTCOMES:

- Learn and describe the process and the uses of systematic reviews and meta-analyses.
- Learn skills required for performing basic systematic reviews and meta-analyses.
- Perform and submit research report by conducting an exercise of Systematic Review and Meta-Analysis on any given/select topic.

COURSE CONTENT:

Theory and application of Systematic Review and Meta-Analysis

This part is classroom teaching and discussion to be carried out by assigned teachers.

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.

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.

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

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, standardized mean difference, cumulative meta-analysis, fixed effect model, random effect model and summary effects

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.

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

Research Component

Distribution of time

10 hours- Choosing a suitable topic using PICO framework, selection of article searches databases and key words. Conducting article search, setting inclusion and exclusion criteria and preparation of PRISMA.

10 hours- Preparation of database for meta analyses. Conversion of Odds ratios to Hazard ratio or Hazard to Odds ratios. Estimation of standard errors from confidence intervals.

10 hours– Meta Analysis: Fixed or Random effects, Heterogeneity Analyses: Funnel Charts; Risk Bias

10 hours- Writing Paper Using Cochran Template and Method Wizard

5 hours- Finalization and submission of the Article according to select journal including reference management.

READING LIST:

Borenstein, M., Hedges, L. V., Higgins, J. P. T., & Rothstein, H. R. (2021). *Introduction to meta-analysis*. John Wiley & Sons.

Card, N. A. (2015). *Applied meta-analysis for social science research*. Guilford Publications.

Egger, M., Smith, G. D., & Altman, D. (Eds.). (2008). *Systematic reviews in health care: Meta-analysis in context*. John Wiley & Sons.

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. https://training.cochrane.org/handbook/current

Leandro, G. (2005). *Meta-analysis in medical research: The handbook for the understanding and practice of meta-analysis*. John Wiley & Sons.

Macaskill, P., Gatsonis, C., Deeks, J., Harbord, R., & Takwoingi, Y. (2010). *Cochrane handbook for systematic reviews of diagnostic test accuracy*. Cochrane Collaboration.

Code: MBD R521

PROJECT ON DATA ANALYTICS

Credit: 3 **Hours: 60**

COURSE OUTCOMES:

- Students should be able to demonstrate a comprehensive understanding of data analytics techniques and tools while delivering impactful, data-driven insights to solve real-world problems.
- After completing the project, students will be able to gain the required technical and research skills for their future prospects in the research and Industry.

PROJECT GUIDELINES:

Recommended Areas:

- Demography, Health, and Social Sciences or an interdisciplinary area.

Each student may choose one topic from the given below suggested list-

1. Development of Monitoring & evaluation framework
2. Sampling Scheme implementation
3. Preparation of data collection tools
4. Replica of analysis of any Published article in peer reviewed journal
5. Generating factsheet or table using large-scale survey data.
6. Interactive Dashboard

Master of Science in Biostatistics and Demography

Course Code	Course Name	Course Type	Credits	Hours	L	T	P	Weightage % Semester Exam	
								Internal Exam	Semester Exam
SEMESTER I									
IKS 401	Indian Knowledge System-1	IKS	2	30	2	0	0	40	60
MBD F401	Basics of Human Biology	F	2	30	2	0	0	40	60
MBD F402	Social Science Concepts	F	3	45	2	1	0	40	60
MBD C401	Introduction to Demography and Data Source	C	3	45	2	1	0	40	60
MBD C402	Basic Demographic Methods	C	3	45	2	1	0	40	60
MBD C403	Methods in Biostatistics I	C	2	30	1	1	0	40	60
MBD C404	Sample Survey Designs	C	2	30	2	0	0	40	60
MBD C405	Basic Concepts and Application of Epidemiology	C	2	30	1	1	0	60	40
MBD E401	Programming with R	E	2	45	1	0	1	60	40
MBD E402	Data Analysis with STATA								
Semester Credits			**21**	**330**					
SEMESTER II									
MBD F403	Introduction to Demographic Packages	F	2	30	1	1	0	60	40
MBD C501	Infectious Disease Epidemiology	C	2	30	2	0	0	40	60
MBD C502	Methods in Biostatistics II	C	2	30	2	0	0	40	60
MBD C503	Healthcare Systems and Policies	C	2	30	1	1	0	40	60
MBD C504	Demographic Theories and Nuptiality	C	2	30	1	1	0	40	60
MBD C505	Advanced Sample Survey Designs	C	2	30	2	0	0	40	60
MBD C506	Survival Analysis	C	3	45	2	1	0	40	60
MBD E501	Large-scale Sample Surveys	E	2	30	1	1	0	60	40
MBD E502	Spatial Analytics								
MBD E503	Programming for Data Analysis with Python			45	1	0	1		
MBD E511	Urbanization, Space and Planning	E	3	45	2	1	0	40	60
MBD E512	Introduction to Longitudinal Data Analysis								
MBD V1	Viva-voce	V1	2						
VAC 401	Value added Course	VAC	NC	30	1	1	0	40	60
MBD I	Internship	I	NC						
Semester Credits			**22**	**345**					

Year 1 Credits			**43**	**675**					
SEMESTER III									
IKS 501	Indian Knowledge System-2	IKS	2	30	2	0	0	40	60
MBD C507	Research Methodology	C	2	30	1	1	0	40	60
MBD C508	Advanced Demographic Methods	C	2	30	1	1	0	60	40
MBD C509	Advanced Methods in Biostatistics	C	2	30	2	0	0	40	60
MBD C510	Data Management and Analysis in SAS	C	2	45	1	0	1	60	40
MBD C511	Demographic Model and indirect methods of Estimation	C	2	30	1	1	0	40	60
MBD E521	Concepts and Measures of Global Health	E	3	45	2	1	0	40	60
MBD E522	Artificial Intelligence and Machine Learning Applications								
MBD E523	Health Economics and Financing								
MBD E524	Monitoring and Evaluation in Population and Health								
MBD E531	Population Ageing and Health Transition	E	3	45	2	1	0	40	60
MBD E532	Gender, Health and Development								
MBD E533	Operations Research in Population and Health								
MBD E534	Population, Environment and Sustainable Development								
MBD E535	Occupational Health								
MBD C512	Methods in Clinical Trials	C	3	45	2	1	0	40	60
Semester Credits			**21**	**330**					
SEMESTER IV									
MBD R501	Research Field Work	R	6	90					
MBD R511	Review paper	R	3	60					
MBD R521	Project on Data Analytics	R	3	60					
MBD R531	Dissertation	R	8	120					
MBD V2	Viva-Voce-II	V2	2						
Semester Credits			**22**	**330**					
Year 2 Credits			**43**	**660**					
TOTAL CREDITS (including 4 credits of viva-voce)			**86**	**1335**					

Notes:

- IKS-Indian Knowledge System course, F-Foundation course, C- Core course, E-Elective course, R-Research, VAC-Value Added Course, V-Viva voce, D- Dissertation, L-Lecture, T-Tutorial and P-Practical.
- NC: Non-Credited courses are not counted for calculating the final grade.
- Core course: Must for all the students and cannot be changed.
- Elective course: One elective course should be opted from a pair.
- Semester I: One elective should be opted from E401/ E402
- Semester II: One elective should be opted from each group i.e. E501/ E502/ E503; E511/ E512
- Semester III: One elective should be opted from each group; i.e. E521/ E522/ E23/ E24; E531/ E532/ E533/ E534/ E35.

Notes:

Internal Examination

Faculty members are given the flexibility to decide 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.

Evaluation criteria of Research Fieldwork (MBD R501)

As the course is of 6 credits, the evaluation must be done considering several aspects, including,

- Quality of the tools
- Robust methodology to conduct the study
- Presentation and defense
- Individual report
- Group report

The teachers should evaluate the students' performance based on the followings criteria:

Content	Weightage %	Marks obtained
Relevance of the topic	10	
Quality of the tools	20	
Methodology to conduct the study	20	
Presentation and defence	20	
Individual report	20	
Group report	10	
Total Marks	**100**	

Note: Total obtained marks should be converted to final grades as per the Institute's guideline

Evaluation criteria of Review Paper (MBD R511)

The teachers should evaluate the students' performance based on the followings criteria:

Content	Weightage %	Marks obtained
PICO Framework	10	
PRISMA	10	

Meta Analyses	20	
Risk Bias analyses	10	
Method Wizard	20	
Final Write-up	30	
Total Marks	**100**	

Note: Total obtained marks should be converted to final grades as per the Institute's guideline.

Evaluation criteria of Project on Data Analytics/ Project on Data Presentation (MBDR521)

Project submission and evaluation criterion:

Evaluation: Students will submit their concept note of their project within one week of the commenced of this project.

S. No.	Topic	Submission
1	Development of Monitoring & evaluation framework	Title, objective of the project, Programme/policy Goal, objectives, Outcome, Output, Process, Input level indicators, with means of verification/source
2	Sampling Scheme implementation	A report including title, objective, Sampling scheme sample size estimation, selection methods, illustration of sampling method adopted, may use any software such as excel, R, STATA and submit their original supporting files with the report
3	Preparation of data collection tools	Title, Research objective, Questionnaire, manual for data quality assurance, Computer Assisted Personal Interview (CAPI), other digital tools
4	Review and Replica of analysis of any Published article in peer-reviewed journal	Summary of the review of the article, syntax/program code files with all associated files.
5	Generating factsheet or table from published factsheet/report of any large-scale survey	Title, objective Methodology including Definition of indicators, respondents, syntax/program code files with all associated files.
6	Interactive Dashboard	Title, Objective, research/project questions, data cleaning steps, Storyline, key messages for policy decision
7	AI/ automate tool related to health and social science	Project Title, Objective, User manual, Application

Their presentation of the project will be evaluated by the evaluation committee of three members.

Particular	Percentage
Presentation	30%

Report/ tools/ syntax	70%

Dissertation: Weightage for evaluation of dissertation: Guide 0.25, Presentation & Defense 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 TIPS. First, the committee members independently assess the 'oral presentation and defense 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 all grades of Guide, Presentation & Defense, 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 defense) 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 coordinator. 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

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