

**FURTHER DETAILS REGARDING MAIN TOPICS OF
PROGRAMME No. 05/2021 (Item No: 1)**

**LECTURER IN STATISTICS AND DEMOGRAPHY
IN MEDICAL EDUCATION**

Category Number: 280/2019

MODULE 1: Random variables and distribution function, Univariate discrete and continuous distributions, Bivariate distributions- Joint, conditional and marginal distributions, generating functions, bivariate random vector, Multinomial and multivariate normal distributions, Sampling distributions and applications. Distributions of functions of random variables, Order statistics, Distributions of order statistics, Distribution of quadratic forms in normal variables. Tests of hypotheses-one sample and two sample problems, Tests of hypothesis about mean vector of a multivariate normal distribution, Hotelling's T^2 and Mahalanobi's D^2 . Classification problem.

MODULE 2: Probability space, Properties of probability measure, independence of events, sequence of events, Borel zero-one law. Conditional Probability and Bayes Theorem. Stochastic convergence in distributions, convergence in probability, almost sure convergence and convergence in the r -th mean, their interrelationships, examples and counter examples, Characteristic function and their elementary properties. Weak and strong law of large numbers, central limit theorem; Introduction to Stochastic processes, classification of stochastic processes, processes with stationary independent increments, Markov process, renewal process, martingales. Markov chains, n -step transition probability and its limits. Poisson process, pure birth process, birth and death processes. Branching process, offspring distribution, extinction probabilities.

MODULE 3: Point estimation, general properties of estimators, Unbiasedness; strong, weak and squared error consistency, invariance property of consistent estimator, Fisher's measure of information, Cramer-Rao inequality. Efficiency,

Likelihood function, Sufficiency, Rao-Blackwell and Lehmann-Scheffe theorems and their applications. Various methods of estimation-MLE, method of moments, minimum chi-square, least-squares and properties of these estimators, location and scale family of distributions, Neyman-Pearson Theory of Testing Hypotheses, Unbiasedness, UMPU, LMP, LMPU, tests of hypotheses concerning a real parameter, Likelihood ratio tests, asymptotic properties, Sequential procedures, SPRT-Wald's identity-OC and ASN functions, Confidence sets, shortest confidence intervals, interval estimation.

MODULE 4: Estimation of population mean and population variance under various methods of probability sampling designs with or without replacement, simple random sampling, PPS sampling, Stratified random sampling, systematic sampling, IPPS sampling, Midzuno-Sen scheme of sampling, Cluster sampling and two stage sampling. Various methods of allocation in stratified random sampling, post-stratification, applications of double sampling for stratified random sampling, Estimation using auxiliary information in survey sampling-ratio estimator, regression estimator, double sampling for ratio and regression method of estimation. General linear models, estimability of linear parametric functions, Gauss-Markov theorem, ANOVA- one-way classification, two-way classification with equal and unequal number of observations per cell, Standard designs: CRD, RBD, LSD, Efficiency of design and comparison. Statistical analysis of symmetrical factorial designs. Total and partial confounding in 2^n , 3^n and p^n experiments. Incomplete block designs, BIBD, PBIBD. missing and mixed plot analysis in RBD, LSD.

Module 5: Sources of Demographic Data: Census-Vital Registration System- Civil Registration System(CRS), Sample Registration System(SRS), Population Register and Sample Surveys- NFHS, NSSO, Quality of Data - Smoothing techniques, Indices - Whipple', Myer's, UN, Chandrasekhar and Deming method. Population composition-Age, Sex - Population Pyramid, Religion, Caste, Education, Language, Income, Marriage and Family. Components of population change: Fertility-Mortality-Migration, Balancing equation, Population Scenario of

India-History of population growth-Population size and growth in states with special emphasis on Kerala.

Module 6: Demographic Measures: Fertility Measures, CBR, ASFR, TFR, GRR, NRR, ASMFR, TMFR, Replacement Index; Measures of Nuptiality – Crude Marriage rate, General Marriage rate, Age – Specific Marriage rate, Total Marriage rate, Mean Age at Marriage, Single Mean Age at Marriage. Mortality Measures – CDR, ASDR, Longevity(e_0^0), Infant Mortality Measures– Infant Mortality Rate, Neonatal mortality rate, Post neonatal mortality, Perinatal mortality, Foetal Death, Childhood mortality rates, Child mortality and Maternal Mortality, Standardization of rates. Methods of Population estimation and Projection – Mathematical and Cohort Component methods, Life table- Types of life table, Columns of Life table, construction and interpretation – Linear, exponential, Reed and Merrell, Greville, Chiang, Keyfitz and Fraunthal, Applications and Uses of Life table.

Module 7: Theories and Models: Population growth theories - Malthus, Optimum, Marx, Demographic Transition. Fertility theories- Freedman, Caldwell, Social and Biological Theories, Kingsly Davis, Blake and Becker Model, Easterlin, Leibenstein. Theories of migration by Ravenstein, Stouffer, Ziffe, Lee, Todaro.

Structure of Population – Stable Population, Quasi-stable population, Stationary Population, Lotka's Stable Population Theory, Applications – Population Momentum, Reproductive value. Model life tables – U. N. Model life table, Coale & Demmeny model life table U. N. model life table for developing countries, Model stable population and Rogers & Castro model migration schedule.

MODULE 8: Population, Health & Development: Population Policy, Definitions, Policy goals and Types of policies, Overview of population policy in Developed and Developing countries and in India. National Health and Family Planning Programme in India-History, MCH Programmes, Reproductive and Child Health Programmes, Health policy: National and state – Critical appraisal, Health Programmes and Health Care Systems in India – National Health Programmes- NRHM, NHM, NUHM.

Epidemiology- Principles of Epidemiology, Sources of data on morbidity, Epidemiological Methods, Measurement of health and diseases, Incidence and prevalence rates of morbidity, Morbidity and Mortality link, Health and Development- Social determinants of health, inter linkages between health and Development at local and national levels, globalization and poverty, impact of development Policies on health, Health equity.

Reproductive Health, Definition, General concepts, Maternal and child health, Prenatal and Antenatal care, sanitation, Hygiene, Reproductive Rights, STD, RTI, HIV/AIDS, Male involvement in Reproductive health- Indian Scenario.

Population and Environment, Density and Carrying capacity- Population Growth and Density Changes, Population and Resources – types of Resources: Physical-Biological and Human. Impact of Population Growth on Resources.

Demography of Ageing, Social aspects of ageing, Economic aspects of ageing, Ageing and Health, Ageing policies and programmes.

Module 9: Linear Algebra: Vector spaces, spans and linear independence, basis, dimension, linear maps, matrix of a linear map, determinants, characteristic polynomials, eigen values and eigen vectors, diagonalisation of matrices, solutions of linear equations and Cayley Hamilton theorem.

Module 10:Real Analysis: Sequences and series of real numbers, limit of a function, continuous functions, uniform continuity, differentiation, mean value theorem, L'Hospital's rules, Taylor's theorem, Riemann integral and its properties, Fundamental theorem of calculus.

NOTE: - It may be noted that apart from the topics detailed above, questions from other topics prescribed for the educational qualification of the post may also appear in the question paper. There is no undertaking that all the topics above may be covered in the question paper