**MASTER OF SCIENCE IN EPIDEMIOLOGY AND BIOSTATISTICS**

**INTRODUCTION**

The primary goals of the Master of Science in Epidemiology and Biostatistics programme are to produce skilled investigators trained to competently conduct formal epidemiologic studies and prepare them for academic research careers nationally and internationally. These objectives will be met through the programme's dedicated faculty mentorship; the design of the curriculum; hands-on experience with study protocol and thesis development; and extracurricular activities such as departmental seminars, workshops and article reviews. Through the programme, students interact with a network of clinical researchers within the country and beyond. As one of the top programmes in clinical research training internationally, the programme is an excellent credential for anyone desiring a career leading to clinical research. The programme is focused on improving health through research involving patients and the health care system. This program provides in-depth knowledge of the research techniques appropriate to epidemiologic research. The programme is designed to be completed in two years of full-time study. Generally, the first year students devote their time to the 'core courses' and the writing of their thesis protocol. In the second year of study, students complete electives and conduct their thesis projects.

**OBJECTIVES**

The programme provides a comprehensive preparation of students to address the various challenges of public health, especially in the design and implementation of clinical epidemiologic studies, and responding to disease situations as appropriate. The obejectives of the programme are to:

(a) Develop graduates who can participate in the formulation  and implementation of health policies

(b) Enhance the development of skills in scientific research and writing that will enable the trainees to work together with biomedical teams

(c) Equip graduates with great depth of knowledge, attitudes and skills for the diagnosis and analysis of clinical epidemiologic issues, bearing the powerful statistical background offered.

(d) Plan, manage and evaluate various epidemiologic programmes in public health

**ADMISSION REQUIREMENTS**

To qualify for admission into the Master Degree candidates shall be.

(a) Holders of at least an upper second-class honours degree from any recognised University in the discipline that is relevant to the applicant's area of specialisation.

(b) Holders of lower second class honours degree from any recognised University evidence in the areas mentioned in 3(a) above and evidence of extensive research experience as demonstrated by publication in peer-reviewed journals.

In addition to the above, applicants must meet the specific requirements of the Masters Programme as approved by the senate.

## CREDITS TRANSFER

A candidate may be exempted from some course units and credit (s) transferred from institutions recognized by the senate, subject to the following conditions:

(a) Must have passed in similar course units at Master's level. Request for exemption should be made in writing to the Director, Board of Postgraduate Studies through the Dean of the School of Health Sciences and must be accompanied by officially endorsed supporting documents.

(b) Candidates may be allowed to transfer up to one-third (1/3) of total number of course units.

(c) Application for transfer will be processed only after payment of the prescribed fees.

## COURSE STRUCTURE AND DURATION

The duration of the programme shall be a minimum of two (2) academic years (4 semesters). An academic year is divided into two Semesters, each comprising 16 weeks. The programme shall be by coursework, examination and thesis. The coursework will be covered during the first year of study while research and thesis will be undertaken in the second year of study. The ccourse shall be offered in units. A course unit is defined as that part of semester subject described by coherent syllabus and taught normally over a period of a semester. It is designed as total of 42 hours of study in a semester. For this purpose, one 1-hour lecture is equivalent 2-hours tutorial or 3-hours practical or any combination as may be approved by the Board of the School of Health Sciences.

All course units will be taught for a total of 42 contact hours, including examinations except project work which will take 480 hours of practical attachment.

**EXAMINATIONS REGULATIONS**

Jaramogi Oginga Odinga University of Science and Technology Examinations rules and regulation shall apply.

**LIST OF COURSES**

**YEAR ONE SEMESTER ONE**

| COURSE CODE | COURSE TITLE | Contact hours | | | Weight (Unit) |
|---|---|---|---|---|---|
| | | Lecture | Practical | Total | |
| HMP 5111 | Principles of Epidemiology | 28 | 14 | 42 | 1C |
| HMP 5114 | Biostatistics | 28 | 14 | 42 | 1C |
| HMP 5115 | Research Methods | 28 | 14 | 42 | 1C |
| HES 5111 | Bioethics | 28 | 14 | 42 | 1C |
| HES 5112 | Demography And Population Health | 28 | 14 | 42 | 1C |
| | **Total** | **140** | **70** | **210** | **5** |

**YEAR ONE   SEMESTER TWO (STUDENTS TO TAKE ALL COURSES)**

| COURSE CODE | COURSE TITLE | Contact hours | | | Weight (Unit) |
|---|---|---|---|---|---|
| | | Lecture | Practical | Total | |
| HES 5121 | Epidemiologic Methods | 28 | 14 | 42 | 1C |
| HES 5122 | Biostatistics for Epidemiologic Methods | 28 | 14 | 42 | 1C |
| HES 5123 | Advanced Biostatistics | 28 | 14 | 42 | 1C |
| HES 5124 | Epidemiological Study Designs | 28 | 14 | 42 | 1C |
| | **Total** | **112** | **56** | **168** | **4** |

**YEAR TWO SEMESTER ONE & TWO**

| Course Code | Course Title | Contact Hours | | | Weight (Units) |
|---|---|---|---|---|---|
| | | Lecture | Practical | Total | |
| HES 5212 | Thesis | 0 | 960 | 960 | 1R |

**COURSE DISTRIBUTION**

**YEAR ONE SEMESTER ONE**

**HMP 5112: PRINCIPLES OF EPIDEMIOLOGY                           42 HOURS**

Definition, the scope, variations in severity of disease, models of disease causation. Epidemiological aspects of infectious disease**:** host-parasite relations, transmission mechanisms, Definitions: outbreaks, epidemic, incubation period, attack rate. Descriptive epidemiology**:** Person - age, sex, ethnicity, social class, occupation; place, time measures of morbidity and mortality; incidence and prevalence rates. Classification of causes of death and limitations. Disease determinants; host, agent and environmental factors; natural history of disease; levels of

disease prevention. Screening in the detection of disease and maintenance of health: criteria for evaluation of screening and screening tests; principles underlying screening programmers in Kenya and other developing countries. Vaccination: clinical and immunological aspects, schedules, adverse effects, vaccine efficacy; EPI programmer. Sources of data on health status: census, vital statistics, morbidity data, health record linkages, surveys (cross-sectional); Limitations of routine data. Population and health: Population trends - World, developing countries, Kenya; demographic and epidemiologic transition. Age-specific health care needs.

## HMP 5114: BIOSTATISTICS                                    42 HOURS

Concepts of probability; normal distribution, binomial distribution, poisson distribution; Bayes' theorem. Types of data. Summarizing and presenting data. Sample size determination. Data analysis: confidence limits and confidence intervals, hypothesis testing; statistical tests; z-score, student t-test, chi-square test, odds-ratio and relative risk. Quantitative and qualitative techniques for describing, assessing and displaying data including patterns of disease morbidity, mortality and disease control measures. Quantitative treatment of biological data. Statistical analysis: variability, probability, parametric and non parametric test of significance; Continuous vs. categorical variables, Descriptive statistics. Statistical tests of association and trends: Categorical vs. non-categorical variables. Relative risks and odds ratios; Data transformation, residuals, outliers, leverage, Influence and cook' distance, F-test, dummy variables, Principles of demographic surveys including morbidity and mortality statistics and structure of human populations; Computer statistical packages. Clinical measurements, biometrics and survival data Application of biostatistics in the evaluation of health services and determination of the impacts of health policy.

## HMP 5115: RESEARCH METHODS                                    42 Hours

Research: definition, nature of use and application. Scientific enquiry; concept, nature of, the process. Types of research: participatory, qualitative, quantitative, operations, evaluative. Types of research designs: Descriptive; cross sectional. Analytical; prospective cohort studies, retrospective studies, case-control. Experimental – randomized clinical trials, community trials/field trials. Quasi - experimental. Bias; confounding. Qualitative- focus groups, key informants, case studies, interviews, observation. Quantitative – observational, experimental, case studies. Health Services Research: Techniques for monitoring and evaluation of performance; stakeholder analysis; health systems research; operationalization of research. Sampling Methods. Data analyses, interpretation, and presentation. Ethics in Health Research. Proposal development. Report writing. Dissemination of research findings.

## HES 5111: BIOETHICS                                    42 HOURS

Definition of ethics and bioethics. Human dignity and human rights. Benefit and harm. Autonomy and individual responsibility Consent. Persons without the capacity to consent. Respect for human vulnerability and personal integrity. Privacy and confidentiality. Equality, justice and equity. Non-discrimination and non-stigmatization. Respect for cultural diversity and pluralism. Solidarity and cooperation. Social responsibility and health. Sharing of benefits. Protecting future generations. Protection of the environment, the biosphere and biodiversity

## HES 5112: DEMOGRAPHY AND POPULATION HEALTH            42 Hours

Techniques used in demographic analysis for the measurement of fertility, mortality, and population structure and change, including migration in human populations; steps in interpreting basic demographic data; usefulness of a demographic approach for the study of population and health issues; how different types of demographic information may be collected. Introduction to global population health, including causes of morbidity and mortality, surveillance systems and vital statistics, and trends over time. Overviews of epidemiology of cancer, cardiovascular, infectious, environmental, psychiatric and nutritional diseases. Fundamentals and methods for studying burden of disease in populations, and how these differ across time, space, groups.

## YEAR ONE SEMESTER TWO

## HES 5121: EPIDEMIOLOGIC METHODS                       42 Hours

The search for causal relations: hypothesis generation, descriptive and cross-sectional studies.

Observational studies: prospective approach, prospective studies, retrospective approach, retrospective studies/case-control studies. Evaluation of evidence-association vs. causation. Prospective vs. retrospective studies/advantages and disadvantages. Experimental methods: clinical trials (therapeutic trials) community trials (prophylactic trials). Confounding bias: Sources of confounding, and strategies in dealing with confounding in observational and clinical studies. Interpretation of results: Differential exposure misclassification, non-differential exposure misclassification, differential disease misclassification, non-differential disease mis classification, strategies in dealing with selection bias. Bias in experimental studies: allocation of subjects, random allocation, attrition and strategies for elimination of bias in experimental studies. Appraisal and critique of published papers. Ethical considerations: Confidentiality, consent and principle of no harm to subjects; procedures and process of ethical approval.

## HES 5122: BIOSTATISTICS FOR EPIDEMIOLOGIC METHODS    42 HOURS

Quality control in epidemiological studies. Causes, causal models and causal inference. Analysis of epidemiological data; fundamentals and logistic. Analysis of epidemiological data; meta-analysis. Presentation of results of epidemiological studies. Data management.  Graphical methods, probability, discrete and continuous distributions, estimation, confidence intervals, and one sample hypothesis testing. Two sample hypothesis testing, nonparametric techniques, sample size determination, correlation, regression, analysis of variance, and analysis of covariance. Concepts in biostatistics as applied to epidemiology, primarily categorical data analysis, analysis of case-control, cross-sectional, cohort studies, and clinical trials. Simple analysis of epidemiologic measures of effect; stratified analysis; confounding; interaction, the use of matching, and sample size determination. Multivariable models in epidemiology for analyzing case-control, cross-sectional, cohort studies, and clinical trials. Logistic, conditional logistics, and Poisson regression methods; simple survival analyses including Cox regression. Laboratory sessions focus on the use of the STATA statistical package and applications to clinical data.

## HES 5123: ADVANCED BIOSTATICSTICS                                42 HOURS

Introduction to data analysis and study design. One-way ANOVA. Models of ANOVA: Model I (fixed); Model II (random). Assumptions of ANOVA. Two-way ANOVA. Multiple regression. Advanced logistic regression models. Poisson and negative binomial regression. Longitudinal data analysis. Multilevel modeling. Statistical computing lessons and tutorials. Discriminant analysis. Exploratory factor analysis (EFA). Structural equation models (SEM). Multivariate analysis of variance (MANOVA). Multivariate regression analysis.  Principal components analysis (PCA). Factor analysis (FA). Canonical correlation analysis. Redundancy analysis. Correspondence analysis (CA). Multidimensional scaling. Discriminant analysis. Linear discriminant analysis (LDA). Clustering systems. Recursive partitioning. Artificial neural networks. Review of estimation and hypothesis testing for categorical data. Survival analysis: contingency tables, linear models; multiple logistic regression, loglinear models; multinomial data; analysis of matched-pair data; random effects models. Introduction to statistical software and data management; including basics of entering, manipulating data and elementary statistical analysis, SAS software, and other packages of potential interest to students (R, Strata, SPSS).

## HES 5124: EPIDEMIOLOGICAL STUDY DESIGNS                 42 HOURS

Causality, effect modification, bias, cohort studies, case-control studies: matching in case control studies, nested case control studies, case cohort studies. Clinical trials: advanced topics in the design of clinical trials. Systematic reviews. Meta-analysis. Interaction, dose-response relationship. Screening. Descriptive studies. Randomized controlled trials. Systematic reviews.

Outbreak investigation. Measures of association. Analysis and interpretation of epidemiological data. Scientific inference; biases and confounding. Diagnosis. Molecular and genetic epidemiology. Pharmacoepidemiology. Nutritional epidemiology. Epidemiology of cardiovascular disease. Epidemiology of AIDS and STDs. Social epidemiology. Concepts and controversies in contemporary clinical epidemiology.

**YEAR TWO SEMESTER ONE AND TWO**

**HES 5212: Thesis**                                **960 Hours**

The thesis will be a detailed written report on a research carried out independently by individual students over a period of two semesters. Each student will conduct his or her research with the approval and under the direction of the designated Departmental Course Coordinator. Research titles are selected with reference to the research interest and capabilities of staff. Projects should be professionally relevant and demand-driven to enhance individual employment prospects.