**Bayero University, Kano (BUK)**

**College of Natural and Pharmaceutical Sciences**

**Faculty of Physical Sciences**

**Department of Mathematical Sciences**

**Statistics Programme**

**Proposed 30% addition to the CCMAS Course Structure**

**Level 100**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Course Code** | **Course Title** | **Units** | **Status** | **LH** | **PH** |
| BUK-MTH103 | Elementary Mathematics III | 2 | C | 30 | - |
| BUK-PHY101 | General Physics I | 2 | E | 30 | - |
| BUK-PHY102 | General Physics II | 2 | E | 30 | - |
| BUK-PHY103 | General Physics III | 2 | E | 30 | - |
| BUK-CHM101 | General Chemistry I | 2 | E | 30 | - |
| BUK-CHM102 | General Chemistry II | 2 | E | 30 | - |
| BUK-CHM107 | General Chemistry Practical I | 1 | E | - | 45 |
| BUK-CHM108 | General Chemistry Practical II | 1 | E | - | 45 |
| BUK-BIO101 | General Biology I | 2 | E | 30 | - |
| BUK-BIO102 | General Biology I | 2 | E | 30 | - |
| BUK-BIO107 | General Biology Practical I | 1 | E | - | 45 |
| BUK-BIO108 | General Biology Practical II | 1 | E | - | 45 |
|  | **Total** | **20** |  |  |  |

**Note:** In 100-Level Statistics, the total number of credit units provided by 70% CCMAS is **23**.

However, a minimum of 30 credit units are required in 100-level courses. Thus, 100 Level Statistics Students are expected to register2 credit compulsory course from Mathematics and 6 credits elective courses from either Physics, Biology or Chemistry courses to make a total of 8 credits

**Level 200**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Course Code** | **Course Title** | **Units** | **Status** | **LH** | **PH** |
| BUK-MTH201 | Mathematical Methods I | 2 | C | 30 | - |
| BUK-MTH203 | Sets Logic and AlgebraI | 2 | C | 30 | - |
| BUK-MTH204 | Linear Algebra I | 2 | C | 30 | - |
| BUK-MTH207 | Real Analysis I | 2 | C | 30 |  |
| BUK-MTH209 | Introduction to Numerical Analysis | 2 | C | 30 | - |
| BUK-STA201 | Quality Control | 2 | C | 30 | - |
|  | **Total** | **12** |  |  |  |

**Note: STA299-Industrial Attachment I** to be carried outduring end of session break.

**Level 300**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Course Code** | **Course Title** | **Units** | **Status** | **LH** | **PH** |
| BUK-STA301 | Demography | 3 | C | 45 | 45 |
| BUK-STA302 | Design and Analysis of Experiment I | 3 | C | 45 | 45 |
| BUK-STA303 | Stochastic Process | 3 | C | 45 | - |
| BUK-STA304 | Lab /Field Work on Experimental Design | 2 | C | - | 45 |
|  | **Total** | **11** |  |  |  |

**Note: STA399-Industrial Attachment II** to commence immediately after second semester examinations to the beginning of the new session.

**Level 400**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Course Code** | **Course Title** | **Units** | **Status** | **LH** | **PH** |
| BUK-STA401 | Sampling Techniques | 3 | C | 45 | 45 |
| BUK-STA402 | Time Series Analysis | 3 | C | 45 | 45 |
| BUK-STA403 | Multivariate Analysis | 3 | C | 45 | - |
| BUK-STA404 | Non-Parametric Statistics | 3 | C | 45 | 45 |
|  | **Total** | **12** |  |  |  |
|  | **Grand Total** | **43** |  |  |  |

**Course Contents and Learning Outcomes**

**100 LEVEL**

BUK-**MTH103: Elementary Mathematics III (Vectors, Geometry and Dynamics) (2 Units C: LH 30)**

**Senate-approved relevance**

This allows graduates to possess skilled and knowledge in geometry, motion in any direction as well as vectors and directions. These translate to productions of quality statistician that will benefit the society. By that, BUK contributes significantly in statistics man power development of the Country.

**Learning Outcomes**

At the end of the course, students should be able to:

1. solve some vectors in addition and multiplication;

2. calculate force and momentum; and

3. solve differentiation and integration of vectors.

4. solve some coordinate geometric problem; circle, parabola, ellipse, hyperbola

**Course Contents**

Geometric representation of vectors in 1-3 dimensions, components, direction cosines. Addition, scalar, multiplication of vectors, linear independence. Scalar and vector products of two vectors. Differentiation and integration of vectors with respect to a scalar variable. Two-dimensional co-ordinate geometry. Straight lines, circles, parabola, ellipse, hyperbola. Tangents, normals. Kinematics of a particle. Components of velocity and acceleration of a particle moving in a plane. Force, momentum, laws of motion under gravity, projectiles and resisted vertical motion. Elastic string and simple pendulum. Impulse, impact of two smooth spheres and a sphere on a smooth surface.

BUK-**PHY101: General Physics I (Mechanics) (2 Units C: LH 30)**

**Senate-approved relevance**

This allows graduates to possess skilled and knowledge in speed, acceleration, distance, motion in any direction. These bring about productions of quality statistician that will benefit the Nigeria. Through this, BUK contributes significantly in statistics man power development of the Country and Africa at large.

**Learning Outcomes**

At the end of the course, students should be able to:

1. identify and deduce the physical quantities and their units;

2. differentiate between vectors and scalars;

3. describe and evaluate motion of systems on the basis of the fundamental laws of mechanics;

4. apply Newton’s laws to describe and solve simple problems of motion;

5. evaluate work, energy, velocity, momentum, acceleration, and torque of moving or rotating objects;

6. explain and apply the principles of conservation of energy, linear and angular momentum;

7. describe the laws governing motion under gravity; and

8. explain motion under gravity and quantitatively determine behaviour of objects moving under gravity.

**Course Contents**

Space and time. Units and dimension. Vectors and scalars. Differentiation of vectors (displacement, velocity and acceleration). Kinematics. Newton’s laws of motion (Inertial frames, impulse, force and action at a distance, momentum conservation). Relative motion. Application of Newtonian mechanics. Equations of motion. Conservation principles in physics (conservative forces, conservation of linear momentum, kinetic energy and work, potential energy). System of particles. Centre of mass. Rotational motion (torque, vector product, moment, rotation of coordinate axes and angular momentum). Coordinate systems. Polar coordinates. Conservation of angular momentum. Circular motion. Moments of inertia (gyroscopes, and precession). Gravitation (Newton’s Law of Gravitation, Kepler’s laws of planetary motion, gravitational potential energy, escape velocity, satellites motion and orbits).

BUK-**PHY102: General Physics II (Electricity & Magnetism)(2 Units C: LH 30)**

**Senate-approved relevance**

This will enable graduates to have skills and be knowledgeable in field of electricity and magnetism. These will greatly help the graduate in order to produce high quality statistician that will benefit the Nigeria. Through this, BUK contributes significantly in statistics man power development of the Country and Africa at large.

**Learning Outcomes**

At the end of the course, students should be able to:

1. describe the electric field and potential, and related concepts, for stationary charges;

2. calculate electrostatic properties of simple charge distributions using Coulomb’s law, Gauss’s law, and electric potential;

3. describe and determine the magnetic field for steady and moving charges;

4. determine the magnetic properties of simple current distributions using Biot-Savart and Ampere’s law;

5. describe electromagnetic induction and related concepts and make calculations using Faraday and Lenz’s laws;

6. explain the basic physical significance of Maxwell’s equations in integral form;

7. evaluate DC circuits to determine the electrical parameters; and

8. determine the characteristics of AC voltages and currents in resistors, capacitors, and Inductors.

**Course Contents**

Forces in nature. Electrostatics (electric charge and its properties, methods of charging). Coulomb’s law and superposition. Electric field and potential. Gauss’s law. Capacitance. Electric dipoles. Energy in electric fields. Conductors and insulators. DC circuits (current, voltage and resistance). Ohm’s law. Resistor combinations. Analysis of DC circuits. Magnetic fields. Lorentz force. Biot-Savart and Ampère’s laws. Magnetic dipoles. Dielectrics. Energy in magnetic fields. Electromotive force. Electromagnetic induction. Self and mutual inductances. Faraday and Lenz’s laws. Step up and step down transformers. Maxwell's equations. Electromagnetic oscillations and waves. AC voltages and currents applied to inductors, capacitors, and resistance.

BUK-**PHY103:General Physics III (Behaviour of Matter)(2 UnitsC: LH 30)**

**Senate-approved relevance**

This will enable graduates to have skills and be knowledgeable at the area on how solids, liquid and gas behave. These will greatly help the graduates in order to produce high quality statistician that will benefit the Nigeria. This of course is part BUK mission and vision thereby contributing significantly in producing qualified statisticians for the development of the Country and Africa at large.

**Learning Outcomes**

At the end of the course, students should be able to:

1. explain the concepts of heat and temperature and relate the temperature scales;

2. define, derive, and apply the fundamental thermodynamic relations to thermal systems;

3. describe and explain the first and second laws of thermodynamics, and the concept of entropy;

4. state the assumptions of the kinetic theory and apply techniques of describing macroscopic behaviour;

5. deduce the formalism of thermodynamics and apply it to simple systems in thermal equilibrium; and

6. describe and determine the effect of forces and deformation of materials and surfaces.

**Course Contents**

Heat and temperature (temperature scales). Gas laws. General gas equation. Thermal conductivity. First Law of thermodynamics (heat, work and internal energy, reversibility). Thermodynamic processes (adiabatic, isothermal, isobaric). Second law of thermodynamics (heat engines and entropy). Zeroth law of thermodynamics. Kinetic theory of gases. Molecular collisions and mean free path. Elasticity (Hooke's law, Young's, shear and bulk moduli). Hydrostatics (Pressure, buoyancy, Archimedes' principles). Bernoulli’s equation and incompressible fluid flow. Surface tension (adhesion, cohesion, viscosity, capillarity, drops and bubbles).

BUK-**CHM101: General Chemistry I (2 Units C: LH 30)**

**Senate-approved relevance**

This allows graduates to possess skilled and knowledge in inorganic Chemistry. These translate to productions of quality statistician that will benefit the society. By that, BUK contributes significantly in statistics man power development of the Country.

**Learning Outcomes**

At the end of this course, the students should be able to:

1. define atom, molecules and chemical reactions;

2. discuss the Modern electronic theory of atoms;

3. write electronic configurations of elements on the periodic table;

4. justify the trends of atomic radii, ionization energies, electronegativity of the elements based on their position in the periodic table;

5. identify and balance oxidation – reduction equation and solve redox titration problems;

6. illustrate shapes of simple molecules and hybridized orbitals;

7. identify the characteristics of acids, bases and salts, and solve problems based on their quantitative relationship;

8. apply the principles of equilibrium to aqueous systems using LeChatelier’s principle to predict the effect of concentration, pressure and temperature changes on equilibrium mixtures;

9. analyse and perform calculations with the thermodynamic functions, enthalpy, entropy and free energy; and

10. determine rates of reactions and its dependence on concentration, time and temperature.

**Course Contents**

Atoms, molecules, elements and compounds and chemical reactions. Modern electronic theory of atoms. Electronic configuration, periodicity and building up of the periodic table. Hybridization and shapes of simple molecules. Valence Forces. Structure of solids. Chemical equations and stoichiometry; Chemical bonding and intermolecular forces, kinetic theory of matter. Elementary thermochemistry. Rates of reaction, equilibrium and thermodynamics. Acids, bases and salts. Properties of gases. Redox reactions and introduction to electrochemistry. Radioactivity.

BUK-**CHM102: General Chemistry II (2 Units C: LH 30)**

**Senate-approved relevance**

This will enable graduates to have skills and be knowledgeable at the area of Physical and Organic Chemistry. These will greatly help the graduates in order to produce high quality statistician that will benefit the Nigeria. This of course is part BUK mission and vision thereby contributing significantly in producing highly qualified statisticians for the development of the Country and world in general.

**Learning Outcomes**

At the end of this course, the students should be able to:

1. state the importance and development of organic chemistry;

2. define fullerenes and their applications;

3. discuss electronic theory;

4. determine the qualitative and quantitative of structures in organic chemistry;

5. describe rules guiding nomenclature and functional group classes of organic chemistry;

6. determine rate of reaction to predict mechanisms of reactions;

7. identify classes of organic functional group with brief description of their chemistry;

8. discuss comparative chemistry of group 1A, IIA and IVA elements; and

9. describe basic properties of Transition metals.

**Course Contents**

Historical survey of the development and importance of Organic Chemistry. Fullerenes as fourth allotrope of carbon, uses as nanotubules, nanostructures, nanochemistry. Electronic theory in organic chemistry. Isolation and purification of organic compounds. Determination of structures of organic compounds including qualitative and quantitative analysis in organic chemistry. Nomenclature and functional group classes of organic compounds. Introductory reaction mechanism and kinetics. Stereochemistry. The chemistry of alkanes, alkenes, alkynes, alcohols, ethers, amines, alkyl halides, nitriles, aldehydes, ketones, carboxylic acids and derivatives. The Chemistry of selected metals and non-metals. Comparative chemistry of group IA, IIA and IVA elements. Introduction to transition metal chemistry.

BUK-**CHM107: General Chemistry Practical I (1 Unit C: PH 45)**

**Senate-approved relevance**

This will make the graduates to have skills and be knowledgeable at Practical aspect of Physical, Inorganic and Organic Chemistry. These will greatly help the graduates in order to produce high quality statistician that will benefit the Nigeria. This of course is part BUK mission and vision thereby contributing significantly in producing highly qualified statisticians for the development of the Country and world in general.

**Learning Outcomes**

At the end of this course, the students should be able to:

1. describe the general laboratory rules and safety procedures;

2. collect scientific data and correctly carrying out chemical experiments;

3. identify the basic glassware and equipment in the laboratory;

4. identify the differences between primary and secondary standards;

5. perform redox titration;

6. recording observations and measurements in the laboratory notebooks; and

7. analyse the data to arrive at scientific conclusions.

**Course Contents**

Laboratory experiments designed to reflect topics presented in courses CHM 101 and CHM 102. These include acid-base titrations, qualitative analysis, redox reactions, gravimetric analysis, data analysis and presentation.

BUK-**CHM108: General Chemistry Practical II (1 Unit C: PH 45)**

**Senate-approved relevance**

This will further allows the graduates to possess the skills and knowledge in the Practical aspect of Physical, Inorganic and Organic Chemistry. These will greatly help the graduates in order to produce high quality statistician that will benefit the Nigeria. This of course is part BUK mission and vision thereby contributing significantly in producing highly qualified statisticians for the development of the Country and world in general.

**Learning Outcomes**

At the end of this course, the students should be able to:

1. identify the general laboratory rules and safety procedures;

2. collect scientific data and correctly carrying out Chemical experiments;

3. identify the basic glassware and equipment in the laboratory;

4. identify and carry out preliminary tests which includes ignition, boiling point, melting point, test on known and unknown organic compounds;

5. perform solubility tests on known and unknown organic compounds;

6. conduct elemental tests on known and unknown compounds; and

7. conduct functional group/confirmatory test on known and unknown compounds which could be acidic / basic / neutral organic compounds.

**Course Contents**

Continuation of CHM107. Additional laboratory experiments to include functional group analysis, quantitative analysis using volumetric methods.

BUK-**BIO 101: General Biology I (2 units C: LH 30)**

**Senate-approved relevance**

This will enable graduates to acquire skills and be knowledgeable at the area of life sciences. Specifically, in the field of zoology. These will greatly help the graduates in order to produce high quality statistician that will benefit the Nigeria. This of course is part BUK mission and vision thereby contributing significantly in producing highly qualified statisticians for the development of the Country and world in general.

**Learning Outcomes**

At the end of lectures, students should be able to:

1. explain cells structures and organisations;

2. summarize functions of cellular organelles;

3. characterize living organisms and state their general reproduction;

4. describe the interrelationship that exists between organisms;

5. discuss the concept of heredity and evolution; and

6. enumerate habitat types and their characteristics.

**Course Contents**

Cell structure and organisation, functions of cellular organelles. Characteristics and classification of living things. Chromosomes, genes; their relationships and importance. General reproduction. interrelationships of organisms (competitions, parasitism, predation, symbiosis, commensalisms, mutualism, saprophytism). Heredity and evolution (introduction to Darwinism and Lamarkism, Mendelian laws, explanation of key genetic terms). Elements of ecology and types of habitat.

BUK-**BIO102: General Biology II (2 Units C: LH 30)**

**Senate-approved relevance**

This allows graduates to possess skilled and knowledge in Plant Biology. These translate to productions of quality statistician that will benefit the society. By that, BUK contributes significantly in statistics man power development of the Country and world at large.

**Learning Outcomes**

At the end of the lectures, students should be able to:

1. List the characteristics, methods of identification and classification of viruses, bacteria and fungi;

2. state the unique characteristics of plant and animal kingdoms;

3. describe ecological adaptations in the plant and animal kingdoms;

4. explain nutrition, respiration, excretion and reproduction in plants and animals; and

5. describe growth and development in plants and animals.

**Course Contents**

Basic characteristics, identification and classification of viruses, bacteria and fungi. A generalized survey of the plant and animal kingdoms based mainly on the study of similarities and differences in the external features. Ecological adaptations. Briefs on physiology to include nutrition, respiration, circulatory systems, excretion, reproduction, growth and development.

BUK-**BIO107: General Biology Practical I (1 Unit C: PH 45)**

**Senate-approved relevance**

This will enable the graduates to possess the skills and knowledge in the Practical aspect of Botany and Zoology. These will greatly help the graduates in order to produce high quality statistician that will benefit the Nigeria. This of course is part BUK mission and vision thereby contributing significantly in producing highly qualified statisticians for the development of the Country and world in general.

**Learning Outcomes**

At the end of this course students should be able to:

1. outline common laboratory hazards;

2. provide precaution on laboratory hazards;

3. state the functions of the different parts of microscope;

4. use the microscope and describe its maintenance;

5. draw biological diagrams and illustrations; and

6. apply scaling and proportion to biological diagrams.

**Course Contents**

Common laboratory hazards. prevention and first aid. measurements in biology. uses and care of microscope. compound and dissecting microscope. Biological drawings and illustration, scaling, accuracy and proportion. use of common laboratory apparatus and laboratory experiments designed to illustrate the topics covered in BUK-**BIO 101.**

BUK-**BIO108: General Biology Practical II (1 Unit C: PH 45)**

**Senate-approved relevance**

This will further allow the graduates to possess the skills and be knowledgeable in the Practical part of Botany and Zoology. These will greatly benefit the graduate thereby producing highly qualified statistician in Nigeria. This is part BUK mission and vision of contributing significantly in producing highly qualified statisticians for the development of the Country and world in general.

**Learning Outcomes**

At the end of this course, students should be able to:

1. describe the anatomy of flowering plants;

2. differentiate types of fruits and seeds;

3. state ways of handling and caring for biological wares;

4. describe the basic histology of animal tissues; and

5. identify various groups in the animal kingdom.

**Course Contents**

Anatomy of flowering plants, primary vegetative body. stem, leaf and root to show the mature tissues namely parenchyma, collenchyma, sclerenchyma, xylem and phloem. Types of fruits and seeds. Care and use of dissecting kits and other biological wares. Dissection and general histology of animal tissues based on vertebrate forms. Morphology and functions of epithelial, muscular, nervous and connective tissues. Examination of various groups of lower invertebrates under microscopes, identification of various groups of organisms in Animal Kingdom and any experiment designed to emphasize the practical aspects of topics in BUK-BIO102.

**200 LEVEL**

BUK-**MTH202: Mathematical Methods (2 Units C: LH 30)**

**Senate-approved relevance**

This allows graduates to possess skilled and knowledge in calculus. As calculus in really needed in probability studies, this of course will really help the University to produce quality statistician that will benefit the society. By that, BUK contributes significantly in statistics man power development of the Country and world in general and this is part of BUK mission and vision of producing qualified statisticians for the development of the Country and world at large.

**Learning Outcomes**

At the end of the course, students should be able to:

1. explain real-valued functions of a real variable;

2. solve some problems using mean value theorem and Taylor series expansion; and

3. evaluate line integral, surface integral and volume integrals.

**Course Contents**

Real-valued functions of a real variable. Review of differentiation and integration and their applications. Mean value theorem. Taylor series. Real-valued functions of two and three variables. Partial derivatives chain rule, extrema, lagrangian multipliers. Increments, differentials and linear approximations. Evaluation of line integrals. Multiple integrals.

BUK-**MTH203: Sets, Logic and Algebra I (2 Units C: LH 30)**

**Senate-approved relevance**

This will enable graduates to have skills and be knowledgeable in sets, logic and algebra. All these areas of mathematics are greatly required by Statistics graduate in order to produce high quality statistician that will benefit the Nigeria. Through this, BUK contributes significantly in statistics man power development of the Country and Africa at large and this is part of BUK mission and vision of producing qualified statisticians for the development of the Country and world at large.

**Learning Outcomes**

At the end of the course, students should be able to:

1. solve various problems using the concept of set theory;

2. recognise Algebraic structures; and

3. describe the meaning of logic in Mathematics.

**Course Contents**

Introduction to the language and concepts of modern mathematics. Topics include: basic set theory: mappings, relations, equivalence and other relations, Cartesian products, binary logic, methods of proof, binary operations. Algebraic structures, semi-groups, rings, integral domains, fields. Homeomorphics. Number systems; properties of integers, rationals, real and complex numbers.

BUK-**MTH204: Linear Algebra I (2 Units C: LH 30)**

**Senate-approved relevance**

Statistics graduates needs skills and knowledge of matrix and all other areas of linear algebra. These will indeed contributes greatly in an attempt to produce high quality statistician that will benefit the Nigeria. This of course is part of BUK mission and vision thereby contributing significantly in producing qualified statisticians for the development of the Country and world at large.

**Learning Outcomes**

At the end of the course, students should be able to:

1. explain vector space;

2. describe linear transformations and their representation by matrices; and

3. calculate algebra of various matrices.

**Course Contents**

Vector space over the real field. Sub-spaces, linear independence, basis and dimension. Linear transformations and their representation by matrices – rings, null space, rank. Singular and non-singular transformation and matrices. Algebra of matrices.

BUK-**MTH207: Real Analysis I (2 Units C: LH 30)**

**Senate-approved relevance**

Statistics graduates require skills and knowledge real numbers. These will indeed contributes greatly in an attempt to produce high quality statistician that will benefit the Nigeria. These will greatly help the graduate to understand how to analyse numbers. Of course, this will translates into producing high quality statistician that will benefit the society. This indeed is part of BUK mission and vision of contributing significantly in producing qualified statisticians for the development of the Country and world at large.

**Learning Outcomes**

At the end of the course, students should be able to:

1. describe convergence of sequence of numbers;

2. discuss the monotone, cauchy sequences;

3. test for convergence of series; and

4. state roles and mean value theorem.

**Course Contents**

Bound of real numbers, convergence of sequence of numbers, Monotone sequences, and the theorem of nested intervals. Cauchy sequences, tests for convergence of series. Absolute and conditional convergence of series and re-arrangements. Completeness of reals and incompleteness of rationale. Continuity/ and differentiability of functions. Rolles’ mean and value theorems for differentiable functions, Taylor series.

BUK-**MTH209: Introduction to Numerical Analysis (2 Units C: LH 30)**

**Senate-approved relevance**

Statistics graduates require skills and knowledge on how to perform numerical analysis. Computational Mathematics is really needed in the area of Statistics. These will indeed contributes greatly in an attempt to produce high quality statistician that will benefit the Nigeria. These will greatly help the graduate to understand how to analyse numbers numerically. Of course, this will translates into producing high quality statistician that will benefit the society. This indeed is part of BUK mission and vision of contributing significantly in producing qualified statisticians for the development of the Country and world at large.

**Learning Outcomes**

At the end of the course, students should be able to:

1. solve some numerical solution of algebraic and transcendental equations;

2. describe curve fitting;

3. discuss error analysis;

4. calculate interpolation and approximation;

5. solve some numerical differentiation and numerical integration problems; and

6. solve some numerical problems in ordinary Differential equations with initial value problems.

**Course Contents**

Solution of algebraic and transcendental equations. Curve fitting. Error analysis. Interpolation and approximation. Zeros of non-linear equations ‘in one variable’. Systems of linear equations. Numerical differentiation and integration. Initial value problems in ordinary differential equation.

**BUK-STA201: Quality Control (2 Units C: LH 30)**

**Senate-approved relevance**

Statistics graduates require skills and knowledge on how to check level of quality of items in order to control it. These will indeed contributes greatly in an attempt to produce high quality statistician that will benefit the Nigeria. These will greatly help the graduate to understand how to perform the quality control. Of course, this will translates into producing high quality statistician that will benefit the society. This indeed is part of BUK mission and vision of contributing significantly in producing qualified statisticians for the development of the Country and world at large.

**Overview**

Statistical quality control (SQC) is the application of statistical methods for the purpose of determining if a given component of production (input) is within acceptable statistical limits and there is some result of production (output) that may be shown to be statistically acceptable to required specification. This highlight the importance of preparing students in statistics with the knowledge and skills on how to ensure that a manufactured product or performed service meets the requirement of the client. The objectives of the course, learning outcomes, and contents are provided to address this need.

**Objectives**

The objective of the course are to:

1. explain the purpose and function of statistical process control
2. describe the basic methods used to achieve process stability
3. describe tolerance limit as a function of component variability
4. evaluate the methods and process of production and suggest further improvements in their functioning
5. describe product control
6. explain in details the different sampling plan
7. describe cumulative sum chart

**Learning Outcomes**

At the end of the course, students should be able to:

1. explain process control;

2. discuss tolerance limit as a component of variability;

3. explain the concept of product control;

4. describe the use of control chart; and

5. demonstrate simple, double and sequential sampling plans.

**Course Contents**

Statistical Quality Control. Quality measurement: Attributes and Variables. Process Control: use of charts to achieve process stability. Control charts for Attributes: p-Charts and c-Charts. Control charts for variable: R-charts and X barcharts. Tolerance limit as a function of component variability. Product control: design of simple, double, multiple and sequential sampling plans.Comparison of different sampling plans. Acceptance Sampling. Cumulative sum chart, feedback theory for controlling continues process.

**300 LEVEL**

**BUK-STA301: Demography (3 Units C: LH 45; PH45)**

**Senate-approved relevance**

Statistics graduates require skills and knowledge to make good decisions in business, government, and social services, among other places. Demographic analysis is very important in area of statistics. These will indeed contributes greatly in an attempt to produce high quality statistician that will benefit the Nigeria. These will greatly help the graduate to understand the characteristics of a population and how it might change in the future, which is important for making decisions. Of course, this will translates into producing high quality statistician that will benefit the society. This indeed is part of BUK mission and vision of contributing significantly in producing qualified statisticians for the development of the Country and world at large.

**Overview**

Demography is concerned with virtually everything that influences, or can be influenced by population size, distribution, process, structure or characteristics. Worldwide issues are really the sum of millions, indeed billions, of individual decisions and personal events, for example, everyone experiences at least two of the basic demographic processes – they are born and they die. In between, most will have children of their own; and some will migrate, at least once. In addition, there chances that you will marry, have children, and divorce. The kinds of support you can expect in old age, the price of gas at the pump, the lines at the supermarket, and the kind of housing you will find, are only a few examples of how our lives rely on demography.

One of the important reasons for studying demography is that population growth can compound and magnify, if not create a wide variety of social, economic, and political problems. Some of the problems associated with the growth of the world‘s population as: food security, pollution, inflation, poor housing, reduced income, increased energy use, unemployment, illiteracy, and lack of individual freedom.

The importance of studying demography is to identify changes within the population such as: the growth of the population, mortality and morbidity rates, migration and also marriage.

Demography is also important to the Environmental Health Officer because it describes human population in all the variables including: age, sex, distribution in space and other characteristic factors in relation to disease and other factors. It also identifies and explains the age in cohorts and this helps in correlation of diseases and other conditions in the population and therefore facilitates targeted control and prevention measures.The objectives of the course, learning outcomes, and contents are provided to address this need.

**Objectives**

The objectives of the course are to:

1. explain the concept of demography
2. develop an understanding of population trends globally
3. describe data collection methods; and participate in demographic data collection
4. calculate some demographic measures
5. interpret correctly demographic phenomena and implication for public health
6. apply the knowledge of demography to public health in general and epidemiology in particular

**Learning Outcomes**

At the end of the course, students should be able to:

1. explain the types and sources of demographic data;

2. describethe methods of collection of population censuses,sample surveys and vital registration;

4. explain the differences between measures of fertility, mortality and migration;

4. differentiate between standardization and decomposition; and

5. explain the concepts of life tables.

**Course Contents**

Types and source of demographic data. Methods of collection of population censuses, sample surveys and vital registration. Evaluation of the quality of demographic data. Measures of fertility, mortality, nuptiality and migration. Standardization and Decomposition. Life tables: construction and application. Framework for developing demographic information systems.

**BUK-STA302: Design and Analysis of Experiments (3 Units C: LH 45; PH 45)**

**Senate-approved relevance**

Training of high-quality graduates who are highly skilled and knowledgeable in experimental design is important in our society. These will indeed contributes greatly in an attempt to produce high quality statistician that will benefit the Nigeria. These will greatly help the graduate to understand how to collect data, data analysis and ensure that conclusions from a study, are valid. This indeed is part of BUK mission and vision of contributing significantly in producing qualified statisticians for the development of the Country and world at large.

**Overview**

Experimental design is the process of carrying out research in an objective and controlled fashion so that precision is maximized and specific conclusions can be drawn regarding a hypothesis statement. Generally, the purpose is to establish the effect that a factor or independent variable has on a dependent variable. The principle of experimental design play an important role in research that does not follow the strict levets of hypothesis testing.

There are several steps in the development of an experiment .The researcher must generate a research question, state a testable hypothesis, determine how to control variability during the experimental process, select or develop intervention conditions, sample from a population in order to assign them to experimental conditions, and determine what empirical measures will be made (and how the data will be recorded).The objectives of the course, learning outcomes, and contents are provided to address this need.

**Objectives**

The objectives of the course are to:

1. identify and apply the basic principles of experimental design, including randomization, replication and control
2. manipulate and present experimental data using appropriate statistical tools
3. use appropriate software to analyse experimental data
4. explain the effect of more than one factor by Anova method
5. describe the concepts of split plot design

**Learning Outcomes**

At the end of the course, students should be able to:

1. explainthe differences between randomisation, replication and blocking;

2. describe the differences between completely randomized, randomized blocks, and latin squares;

3. discuss balanced incomplete blocks design;

4. explain the concepts of split plot design; and

5. outline the application of design of experiments to agriculture, biology and industry.

**Course Contents**

Basic principle of experimentation,Randomisation, replication and blocking. Local control. Basic designs: completely randomized, randomized blocks, Latin squares, Balanced incomplete blocks, split plot. Missing values. Relative efficiency. Estimation and tests of variance components. Multiple comparisons. Departures from underlying assumptions. Applications to agriculture, biology and industry.

**BUK-STA303: Stochastic Processes (3 Units C: LH 45)**

**Senate-approved relevance**

The theory of stochastic processes open up a variety of applications where probabilities and random numbers can help manage large problems. Stochastic analysis is really needed in the area of Statistics. These will indeed contributes greatly in an attempt to produce high quality statistician that will benefit the society. These will greatly help the graduate to understand how to make investment decisions how random events affect population and community dynamics. This indeed is part of BUK mission and vision of contributing significantly in producing qualified statisticians for the development of the Country and world at large.

**Overview**

A stochastic process is a set of random variables indexed by time or space. Stochastic modelling is an interesting and challenging area of probability and statistics that is widely used in applied sciences. In this course, students will gain the theoretical knowledge and practical skills necessary for the analysis of stochastic systems. Students will also be thought the basic concepts of the theory of stochastic processes and explore different types of stochastic processes including markov chains, Poisson processes and birth-and-death processes.The objectives of the course, learning outcomes, and contents are provided to address this need.

**Objectives**

The objectives are to:

1. thoroughly describe the theory of stochastic processes, especially for Random walk
2. define markov chain in discrete and continuous time
3. choose a proper Markov model and conduct proper calculations for different applications, especially regarding the modelling of birth and death processes
4. thorough describe the process of queuing processes as well as their waiting time

**Learning Outcomes**

At the end of the course, students should be able to:

1. explain the concept of random walk;

2. describemarkov processes;

3. describe discrete and continuous time processes;

4. explain birth and death processes; and

5. explain the concepts of queuing processes.

**Course Contents**

Generating functions: tail probabilities and convolutions. Recurrent events. Random walk (unrestricted and restricted). Gamblers ruins problem. Markov processes in discrete and continuous time. Poisson, branching, birth and death processes. Queuing processes: M/M/I, M/M/s, M/a/I queues and their waiting time distribution.

**BUK-STA304: Lab/Field Work on Experimental Design (2 Units C: PH 30)**

**Senate-approved relevance**

Field experiment is really needed in the area of Statistics. This enable statisticians to test theories and answer questions with higher external validity because they simulate real-world occurrence. These will greatly help the graduate to understand how to use statistical packages such as SPSS, NCSS, MINITAB and R software, which are used to solve and analyse statistical problems. Of course, this will translates into producing high quality statistician that will benefit the society. This indeed is part of BUK mission and vision of contributing significantly in producing qualified statisticians for the development of the Country and world at large.

**Overview**

Analysis of variance (ANOVA) represents a set of models that can be fit to data, and also a set of methods that can be used to summarize an existing fitted model. We shall first consider ANOVA as it applies to classical linear models (the context for which it was originally devised; Fisher, 1925) and then discuss how ANOVA has been extended to generalized linear models and multilevel models. Analysis of variance is particularly effective tool for analyzing highly structured experimental data (in agriculture, multiple treatments applied to different batches of animals or crops; in psychology, multi-factorial experiments manipulating several independent experimental conditions and applied to groups of people; industrial experiments in which multiple factors can be altered at different times and in different locations). The objectives of the course, learning outcomes, and contents are provided to address this need.

**Objectives**

The objective of the course are to:

1. have a knowledge of experimentation
2. learn about the basic principle of experimentation
3. understand what completely randomized design (CRD) is all about

**Learning Outcomes**

At the end of the course, students should be able to:

1. demonstrate various statistical package;

2. use some statistical packages in solving problems in statistical methodology; and

3. use packages such as SPSS, NCSS and MINITAB etc, to demonstrate their ability in statistical methodology.

**Course Contents**

Computations based on field and laboratory appraisal of some of the techniques and problems on experimental design.

**400 LEVEL**

**BUK-STA401: Sampling Techniques (3 Units C: LH 45)**

**Senate-approved relevance**

Statistics graduates require skills and knowledge to make good decisions in business, government, and social services, among other places. Sampling techniques is very important in area of statistics. These will indeed contributes greatly in an attempt to produce high quality statistician that will benefit the Nigeria. These will greatly help the graduate to learn and understand how to obtain enough data to solve real life problem without having to query the entire population- saving time and money. This indeed is part of BUK mission and vision of contributing significantly in producing qualified statisticians for the development of the Country and world at large.

**Overview**

Most of the time when we want to conduct research about a group of people (or in general, a population), it might result ineffective or even impossible to collect data from every person in the group. In those cases we must use sampling techniques.

Sampling is a process of selecting a group of observations (sample) from a bigger population to obtain information. There are two (2) types of sampling methods; Probability and Non-Probability Sampling.

Probability Sampling is a sampling techniques in which everyone in the population has an equal chance of being included in the sample while in Non-Probability Sampling , samples selection are based on some subjective judgement rather than random selection.

Sampling is very important because studying the population as a whole is not always optimal. we must be very clear that for each probabilistic sample design, some different formulas and equations determine the sample sizes, both at the level of the total sample and of partial samples (at each stage).The objectives of the course, learning outcomes, and contents are provided to address this need.

**Objectives**

The objectives of the course are to:

1. define and distinguish probability and non-probability sampling
2. define the major types of probability sampling method and indicate when each is preferred
3. distinguish single and double phase sampling scheme
4. describe the concept of optimal allocation with more than one item.

**Learning Outcomes**

At the end of the course, students should be able to:

1. explain the differences between ratio, regression and difference estimation;

2. explain the concept of double sampling;

3. differentiate between multiphase and multistage;

4. demonstrate cluster and stratified sampling

**Course Contents**

Ratio, regression and difference estimation procedures. Double sapling interpreting scheme. Multiphase and Multistage sampling, cluster sampling with unequal sizes; problem of optimal allocation with more than one item. Further stratified sampling.

**BUK-STA402: Time Series Analysis (3 Units C: LH 45; PH 45)**

**Senate-approved relevance**

Statistics graduates require skills and knowledge to make good decisions in business, government, and social services, among other places. Time series analysis is very important in area of statistics. These will indeed contributes greatly in an attempt to produce high quality statistician that will benefit the Nigeria. These will greatly help the graduate to learn and understand the underlying causes of trends or systematic patterns over time and how to forecast organizations business profit or loss trends. This indeed is part of BUK mission and vision of contributing significantly in producing qualified statisticians for the development of the Country and world at large.

**Overview**

Statistical models are significant for understanding and predicting complex data. You can see patterns and relationships and make accurate predictions about future values. A viable area for statistical modelling is time series analysis.

Time Series data are collected overtime and can be found in various fields such as finance, economic and technology. Statistical models can be used to better understand this kind of data, generate meaningful insight and make predictions that helps make critical decisions. This models are mathematical representation of data behaviour and can be used to predict future values. For simple autoregressive models to more complex integrated moving average models, this models offers variety of options for analyzing and forecasting time series data.The objectives of the course, learning outcomes, and contents are provided to address this need.

**Objectives**

The objectives of the course are to:

1. learn how to estimate models parameters
2. distinguish between stationary and non-stationary processes
3. test for auto-correlation and partial auto-correlation
4. explain the basic time-series models: autoregressive (AR) and moving average models
5. familiarise with various statistical models used for time-series analysis
6. learn how to implement this model using several statistical tools
7. understand forecasting techniques

**Learning Outcomes**

At the end of the course, students should be able to:

1. differentiate between non-stationary and stationary processes;

2. explain the concept of auto-correlation and partial auto-correlation;

3. explain the differences between autoregressive, moving average and autoregressive moving average;

4. discuss diagnostic checking of models; and

5. describe forecasting analysis.

**Course Contents**

Estimation and isolation of components of time series. Non-stationary and stationary processes: theoretical moments, auto-correlations and partial auto-correlation; sample moments: auto-correlation; partial auto-correlation; univariate Time series model: identification and estimation- Auto-correlation (AR) Moving (MA) and Auto-regressive Moving (ARMA). Diagnostic checking of models, linear prediction and forecasting analysis

**BUK-STA403: Multivariate Methods (3 Units C: LH 45)**

**Senate-approved relevance**

Multivariate methods is very important in area of statistics. This will enable graduates to have skills and knowledge on how to draw inference about mean vectors. These will greatly help the graduate to learn how to predict future outcomes, improve efficiency, make decisions about policies and processes, correct errors, and gain new insights. This indeed is part of BUK mission and vision of contributing significantly in producing qualified statisticians for the development of the Country and world at large.

**Overview**

Multivariate analysis of variance (MANOVA) as a generalization of the t-test and analysis of variance (ANOVA). The t-test is a strategy to test hypotheses about differences between two groups on a single mean. When there are more than two means, it is possible to use a series of t-tests to evaluate hypotheses about the difference between each pair of group means (e.g., for three groups, there are three unique pairs of means). However, conducting multiple t-tests can lead to inflation of type 1 error rate.

Consequently, ANOVA is used to test hypotheses about differences between three or more groups on a single mean; and MANOVA is a strategy to test hypotheses about differences between two or more groups on two or more means (i.e., a vectors of means). As a generalization of the t-test and ANOVA, MANOVA may be understood as the ratio between two measures of multivariate variance. The objectives of the course, learning outcomes, and contents are provided to address this need.

**Objectives**

The objectives of the course are to:

1. understand the definition of multivariate normal distribution
2. compute eigenvalues and eigenvectors for a 2x2 matrix
3. determine the shape of the multivariate normal distribution from the eigenvalues and eigenvectors of the multivariate normal distribution
4. carryout hotelling’s T-square test for testing a population mean vector that meets specification
5. determine whether linear or quadratic discriminant analysis should be applied to a given datasets
6. be able to apply the linear discriminant function to classify a subject by its measurement
7. carryout principal component analysis using SAS/Minitab
8. assess how many principal components are needed
9. interprets principal component scores and describe a subject with a high or low score
10. understand the terminology of factor analysis, including the interpretation of the factor loadings, specific variances and communalities
11. carryout a canonical correlation analysis using SAS
12. assess how many canonical variate pairs should be considered
13. interprets canonical variate score
14. carryout cluster analysis using SAS
15. use a dendrogram to partition the data into clusters of known composition
16. carryout posthoc analyses to describe differences among cluster

**Learning Outcomes**

At the end of the course, students should be able to:

1. explain the concepts of multivariate normal and related distribution;

2. describemahalanobi’s distance;

3. differentiate between principal and factor analysis;

4. describe canonical correlation;

5. explain cluster analysis; and

6. carryout cluster analysis using SAS.

**Course Contents**

Multivariate normal and related distributions. Inference about mean vectors. Mahalanobis distance, sampling distributions of the mean vector and covariance matrix; Hotelling’s T2; simultaneous inference Multivariate analysis of variance. Tests of independence and homogeneity. Discrimination and classification. Principal components and factor analysis. Canonical correlation analysis. Cluster analysis.

**BUK-STA404: Non- Parametric Methods (3 Units C: LH 45; PH 45)**

**Senate-approved relevance**

Statistics graduates require skills and knowledge in Non-parametric methods. These will indeed contributes greatly in an attempt to produce high quality statistician that will benefit the Nigeria. These will greatly help the graduate to understand how to analyse data with fewer assumption or data that are not scale. Of course, this will translates into producing high quality statistician that will benefit the society. This indeed is part of BUK mission and vision of contributing significantly in producing qualified statisticians for the development of the Country and world at large.

**Overview**

Nonparametric statistics is a method that make statistical inferences without regard to any underlying distribution. The method fits a normal distribution under no assumptions. Habitually, the approach uses data that is often ordinal because it relies on ranking rather than numbers.

Nonparametric statistics includes nonparametric descriptive statistics, statistical models, inference, and statistical tests. The model structure of nonparametric models is not specified a priori but is instead determined from data. The term nonparametric is not meant to imply that such models completely lack parameters, but rather than the number and nature of the parameters are flexible and not fixed in advance.

**Objectives**

The objectives of the course are to:

1. describe order statistics
2. perform and interprets runs tests
3. perform and interprets the chi-square goodness-of-fits
4. describe rank based tests on one and two sample test
5. compute the chi-square test for independence
6. describe measure of association for bivariate sample

**Learning Outcomes**

At the end of the course, students should be able to:

1. explain the concept of order statistics and their distribution;

2. demonstrate one sample and two sample linear ranks tests for location and scale; and

3. identify basic principle of experimentation..

**Course Contents**

Order statistics and their distributions. Tests based on runs. Tests of Goodness of Fits. One sample and two sample linear ranks tests for location and scale. Tests for independent samples. Measure of association for bivariate samples and multiple classification. Basic principle of experimentation.

**SUMMARY**

In summary**, w**e proposed 8 credit units for 100 Level, 12 credit units for 200 Level, 11 credit units for 300 Level, and 12 credit units for 400 Level. Based on this, we have a total of31 credit units for Level100, 33 credit units for Level200, 32 credit units for Level300 and 33 credit units for Level 400, making a total of 129 credit units for the programme.