**Bayero University, Kano (BUK)**

**Life Sciences**

**Microbiology**

**B.Sc. Microbiology**

**Proposed 30% addition to CCMAS course structure/summary**

**Level 100**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **COURSE CODE** | **COURSE TITLE** | **Units** | **STATUS** | **LH** | **PH** |
| BUK-MCB 101 | Introductory General Microbiology | 2 | C | 15 | 45 |
| **Total** |  | **02** |  |  |  |

**Level 200**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **COURSE CODE** | **COURSE TITLE** | **Units** | **STATUS** | **LH** | **PH** |
| BUK-MCB 223 | Microbial Biotechnology | 2 | C | 15 | 45 |
| BUK-MCB 224 | Medical Parasitology and Entomology | 2 | C | 15 | 45 |
| BUK-MCB 232 | Principles of Sterilization & Disinfection | 2 | E | 15 | 45 |
| BUK-MCB 233 | Biorisk Management | 2 | C | 15 | 45 |
| BUK-BIO 201 | Genetics | 2 | C | 15 | 45 |
| BUK-BIO 202 | Introductory Ecology | 2 | E | 15 | 45 |
| BUK-BIO 208 | Biostatistics | 2 | C | 15 | 45 |
| BUK-ZOO 211 | Invertebrates I | 2 | C | 15 | 45 |
| BUK-BCH 201 | General Biochemistry I | 2 | C | 15 | 45 |
| BUK-BCH 202 | General Biochemistry II | 2 | C | 15 | 45 |
| BUK-CHM 210 | Physical Chemistry I | 2 | C | 15 | 45 |
| BUK-CHM 211 | Organic Chemistry I | 2 | C | 15 | 45 |
| BUK-CHM 212 | Inorganic Chemistry I | 2 | C | 15 | 45 |
| **Total** |  | **26** |  |  |  |

**Level 300**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **COURSE CODE** | **COURSE TITLE** | **Units** | **STATUS** | **LH** | **PH** |
| BUK-MCB 301 | Food Quality Assessment and Safety | 2 | E | 15 | 45 |
| BUK-MCB 302 | Soil Microbiology | 2 | C | 15 | 45 |
| BUK-MCB 303 | Biodeterioration | 2 | C | 15 | 45 |
| BUK-MCB 303 | Plant Microbiology | 2 | E | 15 | 45 |
| BUK-MCB 306 | Field Course | 2 | C | - | 90 |
| BUK-MCB 308 | Pharmaceutical Microbiology | 2 | C | 15 | 45 |
| **Total** |  | **12** |  |  |  |

**Level 400**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **COURSE CODE** | **COURSE TITLE** | **Units** | **STATUS** | **LH** | **PH** |
| BUK-MCB 401 | Aquatic Microbiology | 2 | E | 15 | 45 |
| BUK-MCB 403 | Research Methodology | 2 | C | 15 | 45 |
| BUK-MCB 404 | Analytical Microbiology and Quality Control | 2 | C | 15 | 45 |
| **Total** |  | **06** |  |  |  |
|  | **Grand Total** | **46** |  |  |  |

**Bayero University, Kano (BUK)**

**Faculty of Life Sciences**

**Department of Microbiology**

**B.Sc. Microbiology**

BUK-MCB 101 **Introductory General Microbiology** (2CU C; LH 15; PH 45)

**Senate-approved relevance**

Training high quality graduates who are skilled and knowledgeable in application of microorganisms in various fields and proper protocols for isolation as well as identification of microorganisms in Nigeria are in agreement with BUK's mission to address African developmental challenges in the use of microorganisms in industrial production, their roles in disease causation, new approaches in the control of microorganisms as well as their use in pollution control. Relevance is seen in Microbiologists from BUK being able to cultivate microorganisms and write comprehensive report of laboratory investigations.

**Overview**

Introductory general microbiology will introduce microorganisms and their different categories as well as a highlight on diversity of microorganisms in nature. It will give an understanding of the variety of tools that can aid microbial detection and the various ways of controlling microorganisms. Understanding microbes gives us the ability to fight pathogens using immunization, antiseptics, and antibiotics.

Microbiology is used in many aspects of daily life, including food production, biodegradation, the manufacture of commercial goods and genetic engineering. Microorganisms are required in a variety of dishes, for instance they are required for the production of curd and cheese.

**Objectives**

(1) To study the different types of microorganisms in nature

(2) To study the different distribution of microorganisms in nature

(2) To state the applications of microorganisms in various facets of life

(3) To explain the hierarchy of classification and naming system of microorganisms

(4) To identify the techniques of isolating microorganisms

(5) To describe techniques for control and preservation of microorganisms

(6) To write good microbiology laboratory report

**Learning Outcomes**

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

(1) identify two major types of microorganisms and their distribution

(2) state one importance of microorganisms in natural processes

(3) describe the hierarchy of classification and naming system of microorganisms

(4) identify at least ten applications of microorganisms

(5) conduct practicals using techniques and protocols for isolation and cultivation of microorganisms

(6) compose a good microbiology laboratory report

**Course contents**

Definition and scope of Microbiology. Types of Microorganisms, ubiquity and importance of microorganisms in food, water, industry, agriculture, environment, medicine, veterinary medicine, pharmacy and biotechnology. Microbial taxonomy. Basic laboratory equipment and wares used in microbiology laboratory including demonstration on their operations. Safety precautions in microbiology laboratory. Culture media and their classifications. Isolation of microorganisms from various sources. Culture maintenance, Culture preservation. Control of microorganisms. Laboratory report writing.

**Bayero University, Kano (BUK)**

**Faculty of Life Sciences**

**Department of Microbiology**

**B.Sc. Microbiology**

BUK- MCB 223 **Microbial Biotechnology** (3CU C; LH 30; PH 45)

**Senate-approved relevance**

Training of high quality graduates who are highly skilled and knowledgeable in biotechnology based application of microbes and their enzymes are in agreement with BUK’s mission to address African developmental challenges in producing microbiology graduates with vast experience in modern science such as biotechnology field. Relevance is seen in Microbiologists from BUK being able to manipulate microorganisms to produce useful products such as antibiotics, amino acids and Bio-insecticides. The application can be used to address many global problems such as food security, energy security and infectious diseases.

**Overview**

Microbial Biotechnology provides an overview of how microbes are manipulated to solve practical problems through biotechnology. This highlights the importance of preparing microbiology students with the knowledge and skills on how microbes are used to manufacture component of food, consumer products, biological and biomaterials using recombinant DNA technology.

The course is designed to expose students on how to generate products from genetically modified microorganisms and also to learn schemes for choosing microbial hosts and vector expression system. The course also introduce students to application of biotechnology in medical, environmental, Agricultural and industrial fields.

**Objectives**

(1) To describe basic concepts of Molecular Biology

(2) To describe genes and genomics

(3) To explain the roles of genes in recombinant DNA technology

(4) To explain basic biotechnological techniques

(5) To describe the principles of cloning

(6) To describe transformation

(7) To state the application of microbial biotechnology

**Learning Outcomes**

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

(1) explain the basic concepts of Molecular Biology

(2) describe genes and genomics using specific examples of microorganisms

(3) assess the roles of specific genes in recombinant DNA technology

(4) describe the common techniques used in biotechnology

(5) explain the principles of cloning using case study

(6) describe the applications of microbial transformation

(7) justify the applications of microbial biotechnology using case study

**Course content**

Basic concepts of Molecular Biology (Principal macromolecules and other Biomolecules). Introduction to genes and genomics. Gene expression and regulation. Brief history of recombinant DNA technology. Biotechnological techniques, recombinant DNA techniques in biotechnology. Polymerase Chain Reaction (PCR). Preparation of recombinant DNA, Cloning and Cloning vectors. Introduction of DNA into bacteria and yeasts. Selection and Preservation of the transformed microorganisms. Production of Metabolites using microorganisms: Bio-insecticides, Amino acids, Antibiotics etc. Applications of Microbial Biotechnology (Medical, Environmental, Agricultural, Industrial e.t.c).

**Bayero University, Kano (BUK)**

**Faculty of Life Sciences**

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**B.Sc. Microbiology**

BUK-MCB 224 **Medical Parasitology and Entomology** (2CU C; LH 15; PH 45)

**Senate-approved relevance**

Training of high quality graduates who are highly skilled and knowledgeable in medical parasitology and Entomology are in agreement with BUK’s mission in producing microbiology graduates with vast experience in public health such as the aspect of diagnosis, epidemiology and control of parasites and arthropods of medical importance. Relevance is seen in Microbiologists from BUK being able to participate and facilitate the aspect of treatment and prevention of parasitic diseases.

**Overview**

Medical parasitology and entomology concepts including pathology, ecology, diagnosis and control of parasites and arthropods of medical importance is an important component in preparing microbiology students in the field of medicines.

This course is designed to enable students learn details on major parasites of medical importance and their vectors including history, epidemiology, morphology, habitat, life cycle, modes of infection, pathogenesis, clinical features, diagnosis, treatment, prevention and control. Students will also gain specialized skills on new innovative diagnostic techniques as well as multidisciplinary approaches involving molecular, biochemical, physiological and microbiological perspectives towards understanding the role and the relationship of parasites, vectors and humans.

**Objectives**

(1) To explain the concept of parasitism

(2) To explain pathogenicity of parasites

(3) To describe virulence pathogenicity of parasites

(4) To determine the epidemiology of parasites of economic importance

(5) To describe the process of diagnosis

(6) To discuss how to control and prevent parasites

(7) To identify the different disease vectors

(8) To characterize different disease vectors

**Learning Outcomes**

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

(1) explain the concept of parasitism using host-parasite relationship

(2) describe the concept of virulence

(3) explain the concept of pathogenicity

(4) explain the epidemiology of parasites of economic importance

(5) describe the process of diagnosing common parasitic infections

(6) assess the control measures for parasites and parasitic infections humans and other animals

(7) list preventive measures for parasites and parasitic infections humans and other animals

() identify the different disease vectors of public health significance

(8) characterize the different disease vectors of public health significance

**Course contents**

Introduction to Parasitism, Host Parasite Relationship, characteristics, morphology, lifecycle, pathogenesis, epidemiology, diagnosis and control of intestinal and luminal protozoa. Amoebae (*Entamoeba* species, *Dientamoeba fragilis*, *Endolimax nana, Iodamoeba butschili, Chilomatix mesnili*), pathogenic free-living amoebae (*Naegleria fowleri, Acanthamoeba* species). Ciliates: *Balantidium coli*. Blood and tissue flagellates: *Trypanosoma brucei gambiense*, *T. brucei* rhodesiense, *Trypanosoma cruzi* (Chaga’s disease), *Leishmania* species. Intestinal and luminal flagellates (*Giardia lamblia* and related species, *Trichomonas vaginalis*, *T. tenax*, *T. hominis*). Tissue coccidia (*Toxoplasma gondii*, *Cryptosporidium parvum, Sarcocystis hominis, Isospora belli, Cyclospora cayetanensis*). Malaria parasites (*Plasmodium* species), *Babesia* species. Study of the following insects; *Glossina species*, *Musca domestica*, Black fly, Mosquitoes, Fleas etc.

**Bayero University, Kano (BUK)**

**Faculty of Life Sciences**

**Department of Microbiology**

**B.Sc. Microbiology**

BUK-MCB 232 **Principles of Sterilization and Disinfection** (2CU E; LH 15; PH 45)

**Senate-approved relevance**

Training of high quality graduates who are highly skilled and knowledgeable in designing measures of controlling microorganisms through the process of sterilization and disinfection are in agreement with BUK’s mission in producing microbiology graduates with an expertise in basic techniques of controlling microorganisms. Relevance is seen in Microbiologists from BUK being able to practice basic microbiological control techniques to ensure aseptic condition, prevent cross contamination and transmission of infectious pathogens.

**Overview**

Sterilization and disinfection techniques are essential and basic processes for ensuring aseptic condition prevent contamination and transmission of disease agents. The concept is applied in the laboratory, health centres, food and pharmaceutical industries to control the growth and negative activities of microorganisms.

This course is introduced to the students to enable them understand the principles, procedures, operations, mechanism of actions and application of physical, chemical and biological agents of microbial controls.

**Objectives**

(1) To explain the concept of sterilization

(2) To explain the concept of disinfection

(3) To differentiate types of antiseptics and disinfectants

(4) To differentiate between the mode of action of antiseptics and disinfectant

(5) To determine the effectiveness of disinfectants

**Learning outcomes**

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

(1) explain the concept of sterilization

(2) explain the concept of disinfection using specific examples

(3) differentiate types of antiseptics and disinfectants using specific examples

(4) differentiate between the modes of action of antiseptics and disinfectants using relevant examples

(5) conduct a practical on the effectiveness of disinfectants using MIC, Phenol coefficient, Chick-Martin, Kelsey-Sykes and the in-use tests.

**Course content**

General Introduction and definition of terms. Methods of Sterilization: Physical (Heat, Radiation, Filtration, etc). Chemical (Gaseous and liquids), Disinfection and Antisepsis. Desirable properties of effective disinfectants and antiseptics. Disinfectants/Antiseptics: Phenols, Alcohols, Quaternary ammonium compounds, Halogens and Dyes. Miscellaneous agents (Chlorhexidine, Dequalinum compounds, Heavy metals and their compounds). Evaluation of Disinfectants: Assessment of bacteriostatic activity. Minimum inhibitory concentration. Minimum bacteriocidal concentration, Time survival technique. Rideal-Walker (Phenol coefficient) test. Chick- Martin test. Kelsey- Sykes test. The in-use test.

**Bayero University, Kano (BUK)**

**Faculty of Life Sciences**

**Department of Microbiology**

**B.Sc. Microbiology**

BUK-MCB 233 **Biorisk Management** (2CU C; LH 15; PH 45)

**Senate-approved relevance**

Training of high quality graduates who are highly skilled and knowledgeable in biorisk management is in agreement with BUK’s mission in producing microbiology graduates with vast knowledge on global health security. Relevance is seen in Microbiologists from BUK being able to develop appropriate biosafety and biosecurity programs to reduce or eliminate the risk of potential exposure to biological hazards.

**Overview**

Biorisk management is an important approach to prevent diseases among personnel and to protect community from harm by preventing the release of infectious agents. This highlights the importance of preparing microbiology students with the knowledge and skills on principle of biosafety and biosecurity frameworks.

The course is designed to enable students learn risk assessment, risk control and biosafety program management. Laboratory biosafety also consists of containment principles, technologies and practices implemented to prevent unintentional exposure to pathogens and toxins or their unintentional release. The course also introduces student to laboratory biosecurity measures including protection, control and accountability for valuable biological materials within laboratories in order to prevent their unauthorized access, loss, theft, misuse, diversion or intentional release.

**Objectives**

The objectives of the course are to:

1. explain biorisk, biohazard and biosafety

2. identify biorisk, bioharzard and biosafety in laboratory, environment and health

3. assess biorisk, bioharzard and biosafety in laboratory and environment

4. describe the biorisk management framework

5. describe the techniques for biological waste management

6. discuss relevance of biorisk management in global health security framework

7. discuss biosecurity and biocontainment measures

**Learning Outcomes**

1. explain at least one concept each of biorisk, biohazard and biosafety

2. identify at least three biorisk, biohazard and biosafety in laboratory,

environment and health

3. Give three distinctions of biorisk, biohazard and biosafety in

laboratory and environment

4. describe at least one framework for biorisk management

5. apply the techniques for at least two biological waste management

6. explain one relevance of biorisk management in global health security

framework

7. assess biosecurity and biocontainment measures using two relevant examples

**Course content**

Definition of common terms (risk, hazard, threat, biorisk, biosafety, biosecurity, biorisk management, valuable biological materials, risk assessment, risk characterization and risk mitigation). Risk associated with biological work, Biorisk management framework. Assessment, mitigation and performance (AMP) model. Basic Biosafety and Biosecurity risk assessment. Performance evaluation and its importance. Relevance of Biorisk management in global health security framework. Biological Waste and Waste Management. Record and Record Keeping, etc. Identifying Biological risk spectrum and Biological Safety and Security tools using case studies. Biosafety in Microbiology and Molecular Biology. Introduction to agents of bioterrorism. Assessment of biological hazards and risks. Biorisk Mitigation via personal protective equipment and biosafety cabinets.

**Bayero University, Kano (BUK)**

**Faculty of Life Sciences**

**Department of Microbiology**

**B.Sc. Microbiology**

BUK-BIO 201 – **Genetics**  (2 Units Core: LH 30, PH)

**Senate-approved relevance**

Training of high quality graduates who are highly skilled and knowledgeable in genetics with plant bias is in agreement with BUK’s mission in producing microbiology graduates with vast knowledge on global health security. Relevance is seen as manipulations will be developed on how many staple crops will be genetically modified to increase yields, confer pest and disease resistance, provide resistance to herbicides, or to increase their nutritional value.

**Overview**

Genetics is the study of genes, genetic variation, and heredity specifically in plants. It is generally considered a field of biology and botany, but intersects frequently with many other life sciences and is strongly linked with the study of information systems.

The course is also designed to enable students learn manipulations on how staple crops will be genetically modified to increase yields, confer pest and disease resistance, provide resistance to herbicides, or to increase their nutritional value.

**Objectives**

The objectives of the course are to:

1. Teach students differences between heritable and non-heritable characteristics;
2. Train students on the likelihood of genetic events (Probability)
3. Expose students to how well genetic events (results) fit into a set of observation;
4. Guide students on polygenic variations; and
5. Tutor students on the concepts in population genetics.

**Learning outcomes**

On completion of the course, students should be able to:

1. Distinguish between heritable and non-heritable characteristics;
2. Explain the likelihood of genetic events (Probability)
3. Describe how well genetic events (results) fit into a set of observation;
4. Discuss polygenic variations; and
5. Describe concepts in population genetics.

**Course contents**

Molecular basis of heredity; chromosome structure; patterns of Mendelian and non-Mendelian inheritance; evolution; biotechnological applications; Hereditable and non-hereditable characteristics; Probability and tests of goodness of fit; Quantitative inheritance; variation in genome structure; introduction to population genetics.

**Bayero University, Kano (BUK)**

**Faculty of Life Sciences**

**Department of Microbiology**

**B.Sc. Microbiology**

BUK-BIO 202 **Introductory Ecology** (Units = 2, Status = C, LH = 15, PH = 45)

**Senate approved relevance**

Training of high quality scientists, that are knowledgeable in the ecology of animals, plants, and the environments, who can use their knowledge to conduct ecological studies, with the view to have sound ecological insights in line with the vision, mission and strategic goals of Bayero University, Kano.

**Overview**

The course is designed to expose students to the basic concepts of ecosystem as an interactive scheme, where different species live together and interact with one another, under the influence of biotic and abiotic factors.

The course will also make the students identify ecology at community level, natural destruction, successes of community interaction and dynamics of population with the view to prepare students who will play role, where possible, towards attaining a healthy and sustainable ecosystem for the benefit of mankind.

**Objectives**

The objectives of the course are to:

1. Explain various concepts and terminologies associated with ecosystem;
2. List the features of various habitat types;
3. Explain natural destruction/disaster,
4. explain community and natural cycles; and
5. describe factors responsible for changes in population

**Learning Outcomes**

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

1. explain at least three concepts and seven terminologies associated with ecosystem;
2. list four features of various habitat types;
3. explain at least seven natural destructions/disasters,
4. explain community cycle and five natural cycles;

5. describe five factors responsible for changes in population.

**Course contents**

Concept and definition of ecosystem. Autecology and synecology. Ecology at community level. Ecological classification.Molecular Ecology. Organismal Ecology. Population Ecology. Global Ecology. Landscape Ecology. Habitat types. Terrestrial biomass. Aquatic biomass. Specific features of each biomass. Biotic components of habitat. Natural destruction. Factors of communities. Success of community interaction. Natural cycle. Dynamics of population.

**Bayero University, Kano (BUK)**

**Faculty of Life Sciences**

**Department of Microbiology**

**B.Sc. Microbiology**

BUK - BIO 208: **Biostatistics**  (2 Units C: LH 15; PH 45)

**Senate-approved relevance**

Produce graduates with the ability and skills to apply Biostatistics in conduct of research, generation, transformation and interpretation of data.

Relevance is recognized in the ability of graduates from Microbiology (BUK) to explain conduct research with the application of Biostatistics, which will result in production of accurate and acceptable cutting – edge research outputs.

**Overview**

Biostatistics is designed to enable graduates acquire broad based knowledge on application of statistical tools.

Biostatistics provides broad based education that allows for the design and conduct of good researches, which translates to results that would be used to enhance human well – being.

The course is designed to expose students to the basics of Biostatistics and its application in the study of Microbiology.

**Objectives**

The objectives of the course are to:

1. To teach variability in biological data: continuous and discontinuous variables.

2. To enumerate statistical sampling procedures.

3. To conduct observations and problems of estimation.

4. To discuss representation and summarization of biological data.

5. To explain frequency distribution, measures of central tendency and dispersion.

6. To state the Probability theory.

7. To conduct t-test, f-test and chi-square test, analysis of variance (ANOVA) and covariance.

8. To teach principles of experimental design.

9. To determine correlation, linear and curvilinear regression and transformation.

**Learning Outcomes**

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

1. differentiate between continuous and discontinuous data;

2. explain sampling procedures in biology;

3. summarize and present biological data;

4. describe measures of central tendency and probability theory; and

5. conduct ANOVA, Chi-square, t-tests and F-tests and state their importance.

**Course Contents**

Variability in biological data: continuous and discontinuous variables. statistical sampling procedures. observations and problems of estimation. representation and summarization of biological data. frequency distribution. measures of central tendency and dispersion. Probability theory. normal, binomial and Poisson distribution. t-test, f-test and chi-square test. analysis of variance (ANOVA) and covariance. principles of experimental design. correlation, linear and curvilinear regression and transformation.

**Bayero University, Kano (BUK)**

**Faculty of Life Sciences**

**Department of Microbiology**

**B.Sc. Microbiology**

BUK-ZOO 211 **Invertebrate Zoology** (2 Units; Core; L = 30, PH =45)

**Senate-approved relevance**

Training of high-quality graduates with sound knowledge on the most diverse group of animals on earth is in line with the University’s objective and mission. The students shall apply the knowledge gained on the functional role of invertebrate group in the natural environment and human society.

**Overview**

The course introduces students to the diversity of invertebrates, which are the vast majority of all animals on the planet. It covers the development, adult anatomy, biology and evolutionary relationships of the main animal phyla including Porifera, Coelenterate, Platyhelminths, Nematoda, Entoprocta, Nemertinea, Acanthocephala, and Rotifera

**Objectives**

The objectives of the course are to:

1.explain the diversity of lower invertebrates

2.state the classification of lower invertebrates

3. explain the morphology, life cycle and physiology of lower invertebrates

4. study the evolutionary origin of lower invertebrate

5. compare and contrast the morphology, life cycle and physiology of different lower invertebrates’ groups

**Learning Outcomes**

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

1. describe the variety of lower invertebrate animals

2. explain the evolutionary origin and diversity of lower invertebrate

3. compare and contrast the morphology, life cycle and physiology of different lower invertebrates’ groups;

4. have practical experiences in laboratory and field conditions, to identify lower invertebrate taxonomic groups; and

5. communicate the role of invertebrates in the evolution of animal life to specialist and non-specialist audiences.

**Course Contents**

Introduction to the diversity of lower invertebrates. Classification of lower invertebrates. Morphology life cycle and physiology of lower invertebrates. Identification of lower invertebrates. The systematics, inter-relationship, and basic organization of the lower invertebrates, of the Phylum Protozoa, Porifera, Coelenterate, Platyhelminths, Nematoda, Entoprocta, Nemertinea, Acanthocephala, and Rotifera.

**Bayero University, Kano (BUK)**

**Faculty of Life Sciences**

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BUK - BCH 201 **General Biochemistry I** (2 Units C: LH 15; PH 45)

**Senate-approved relevance**

Produce graduates with the ability and skills to explain the biochemical processes in living cells of plants and animals.

Relevance is recognized in the ability of graduates from Microbiology (BUK) to explain the chemical processes occurring in living organisms.

**Overview**

Biochemistry is designed to enable graduates acquire broad based knowledge on chemical processes in living organisms ranging from single to multi- cellular organisms, both plants and animals.

Biochemistry provides broad based education that explains chemical processes that take place in living organisms and the causes of various deviations, which can invariably lead to pathological conditions. It also provides basis for manipulation of normal processes to achieve desired outcome.

The course is designed to expose students to basic chemical processes that take place in living cells.

**Objectives**

The objectives of the course are to:

1. provide students with a broad and balanced foundation of biochemical knowledge;
2. develop in students the ability to apply knowledge and skills to solving basic theoretical problems in Biochemistry;
3. develop in students, a range of transferable skills that are of value in Biochemistry and related fields.
4. provide students with knowledge and skills base from which they can proceed to further studies in specialized areas of Biochemistry or multi-disciplinary areas involving Biochemistry;
5. provide, through training and orientation, an appreciation of the rewards of inter- and multidisciplinary approach to the solution of complex life problems; and
6. generate in students an appreciation of the importance of Biochemistry in industrial, economic, environmental, technological and social development.

**Learning Outcomes**

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

1. explain the structure of different macromolecules in biological system;
2. identify types of chemical reactions involving these macromolecules;
3. explain the various methods of isolation of these macromolecules;
4. estimate the effects of acids and alkalis on the macromolecules;
5. describe purification of macromolecules; and
6. discuss quantification of the various macromolecules.

**Course Contents**

Introductory chemistry of amino acids, their properties, reactions and biological functions. Classification of amino acids: neutral, basic and acidic; polar and non-polar; essential and nonessential amino acids. Peptides. Introductory chemistry and classification of proteins. Biological functions of proteins. Methods of their isolation, purification and identification. Primary, secondary, tertiary and quaternary structures of proteins. Basic principles of tests for proteins and amino acids. Introductory chemistry of carbohydrates, lipids and nucleic acids. Nomenclature of nucleosides and nucleotides, effects of acid and alkali on hydrolysis of nucleic acids.

**Bayero University, Kano (BUK)**

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**Department of Microbiology**

**B.Sc. Microbiology**

BUK - BCH 202 **General Biochemistry II**  (2 Units C: LH 15; PH 45) (5)

**Senate-approved relevance**

Produce graduates with the ability and skills to explain the biochemical processes in living cells of Microorganisms.

Relevance is recognized in the ability of graduates from Microbiology (BUK) to explain the chemical processes occurring in microorganisms.

**Overview**

Biochemistry is designed to enable graduates acquire broad based knowledge on chemical processes in Microorganisms.

Biochemistry provides broad based education that explains chemical processes that take place in living organisms and the causes of various deviations, which can invariably lead to pathological conditions. It also provides basis for manipulation of normal processes to achieve desired outcome.

The course is designed to expose students to basic chemical processes that take place in living cells, specifically microorganisms

**Objectives**

The objectives of the course are to:

1. To define the cell theory.

2. To state the structures and functions of major cell components.

3. List cell types, constancy and diversity.

4. To describe Cell organelles of prokaryotes and eukaryotes.

5. To describe Chemical composition of cells.

6. To explain Centrifugation and methods of cell fractionation.

7. To describe Structure, function and fractionation of extracellular organelles.

8. To explain Regulation of water and electrolyte balance.

9. To identify pH and pK values and their effects on cellular activities.

**Learning Outcomes**

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

1. explain the structure of the cell including its components;

2. discuss the interrelationship between different organelles of the cell;

3. recognize the differences between plant and animal cells;

4. isolate the various organelles of both plant and animal cells; and

5. describe the influence of hydrogen ion concentration on cellular function.

**Course Contents**

The cell theory. Structures and functions of major cell components. Cell types, constancy and

diversity. Cell organelles of prokaryotes and eukaryotes. Chemical composition of cells. Centrifugation and methods of cell fractionation. Structure, function and fractionation of extracellular organelles. Water, total body water and its distribution. Regulation of water and

electrolyte balance. Disorder of water and electrolyte balance. Acidity and alkalinity, pH and pK

values and their effects on cellular activities.

**Bayero University, Kano (BUK)**

**Faculty of Life Sciences**

**Department of Microbiology**

**B.Sc. Microbiology**

BUK - CHM 210 **Physical Chemistry I** (2 Units C: LH 15; PH 45) (5)

**Senate-approved relevance**

BUK‘s mission to address African challenges in producing competent graduates in natural and health sciences. In line with this mission, it is important to introduce a course for B.Sc. Microbiology students that play an important role in our food, clothes, paper, ink, rubber, soap, perfumes, and medicines as they are indispensable to us for proper living.

**Overview**

Physical chemistry is one of the most important branches of chemistry, contributive in many other scientific fields, including but not limited to Microbiology, Biology, Medicine, Biotechnology, Botany, Zoology, and Pharmacy, e.t.c.

The course is also designed to expose students to the study of macroscopic and microscopic phenomena in chemical systems which are important in sustaining biological system. Without physical chemistry, it would be difficult to explore the mechanisms of different changes occurring during metabolism. In addition, physical chemistry provides detailed information about how different physical chemicals react to other compound and which products are released in our bodies as a result of the chemical reactions.

**Objectives**

The objectives of the course are to:

1. explain the kinetic theory of gases and solve problems related to ideal and real gases;
2. Teach students on how to describe the theory of gases and solve problems related to ideal and real gases;
3. Use numerical or computational methods to calculate physical properties of Chemical

systems and assess the appropriateness of different computational techniques and numerical

1. approximations for solving physical chemistry problems;
2. Tutor students on fundamental concepts of physical chemistry including those of statistical mechanics, chemical Kinetics, quantum mechanics and spectroscopy;
3. Expose students to different concentration terms which include molarity, normality etc. explain vapour pressure lowering of the solvent, boiling point elevation of solutions, freezing point depression of solution and measurement of osmotic pressure;
4. Explain what photochemical reactions entails, and
5. Expose the students to basic electrochemistry

**Learning Outcomes**

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

1. state the kinetic theory of gases and solve problems related to ideal and real gases;
2. derive the formula for molecular velocity of gases and use the derived formula to solve problems.
3. describe and explain the fundamental concepts of physical chemistry including those of statistical mechanics, chemical Kinetics, quantum mechanics and spectroscopy;
4. apply simple models to predict properties of chemical systems;
5. define and state type of solutions; define different concentration terms which include molarity, normality etc. explain vapour pressure lowering of the solvent, boiling point elevation of solutions, freezing point depression of solution and measurement of osmotic pressure;
6. apply numerical or computational methods to calculate physical properties of Chemical systems and assess the appropriateness of different computational techniques and numerical approximations for solving chemistry problems;
7. design and plan an investigation by selecting and applying appropriate practical, theoretical, and/or computational techniques or tools; and
8. states Ohms law and describe the electrolytic conduction, states the Faraday’s Law and Conductance Law of solution and calculation on electrical conductance on different electrolyte solution.

**Course Contents**

Kinetic theory of gases; science of real gases; the laws of thermodynamics; entropy and free

energy; reactions and phase equilibria; reaction rates; rate laws; mechanism and theories of

elementary processes; photochemical reactions; basic electrochemistry.

**Bayero University, Kano (BUK)**

**Faculty of Life Sciences**

**Department of Microbiology**

**B.Sc. Microbiology**

**BUK -CHM 211: Organic Chemistry I (2 Units C: LH 15; PH 45)**

**Senate-approved relevance**

BUK‘s mission to address African challenges in producing competent graduates in natural and health sciences. In line with this mission, it is important to introduce a course for B.Sc. Microbiology students that play an important role in our food, clothes, paper, ink, rubber, soap, perfumes, and medicines as they are indispensable to us for proper living.

**Overview**

Organic chemistry is one of the most important branches of chemistry, contributive in many other scientific fields, including but not limited to biotechnology, microbiology, biochemistry, earth sciences, Botany, zoology, medicine, e.t.c.

The course is also designed to expose students to chemical reactions that take place in living beings because without organic chemistry, it would be difficult to explore the mechanisms of different changes occurring during metabolism. In addition, organic chemistry provides detailed information about how different organic chemicals react to other compound and which products are released in our bodies as a result of the chemical reactions.

**Objectives**

The objectives of the course are to:

1. Prepare students on how to solve problems in chemistry of aromatic compounds;
2. Teach students on how to describe the structures of simple sugars, starch and cellulose, peptides and proteins and show the difference in their conformation structure;
3. Train students on how best problems in chemistry of bifunctional compounds could be solved;
4. Tutor students on the mechanisms of substitution, elimination, addition and rearrangement reactions;
5. Expose students to stereochemistry and its application;
6. Teach students condition and pathways of the following organic reactions - Grignard reaction, Aldol and related reactions; and
7. Guide students on simple alicyclic carbon compounds and their synthesis.

**Learning Outcomes**

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

1. Describe and solve problems in chemistry of aromatic compounds;
2. Describe the structures of simple sugars, starch and cellulose, peptides and proteins and show the difference in their conformation structure;
3. Describe and solve problems in chemistry of bifunctional compounds;
4. Explain the mechanisms of substitution, elimination, addition and rearrangement reactions;
5. Describe stereochemistry and its application;
6. Describe condition and pathways of the following organic reactions - Grignard reaction, Aldol and related reactions; and
7. Describe simple alicyclic carbon compounds and their synthesis.

**Course Contents**

Chemistry of aromatic compounds. Structures of simple sugars, starch and cellulose, peptides, and proteins. Chemistry of bifunctional compounds. Energetics, kinetics, and the investigation of reaction mechanisms. Mechanisms of substitution, elimination, addition, and rearrangement reactions. Stereochemistry. Examples of various named organic reactions e.g., Grignard reaction, Aldol and related reactions. Simple alicyclic carbon compounds and their synthesis.

**Bayero University, Kano (BUK)**

**Faculty of Life Sciences**

**Department of Microbiology**

**B.Sc. Microbiology**

BUK - CHM 212: **Inorganic Chemistry I**  (2 Units C: LH 15; PH 45)

**Senate-approved relevance**

BUK‘s mission to address African challenges in producing competent graduates in natural and health sciences. In line with this mission, it is important to introduce a course for B.Sc. Microbiology students that play an important role in our food, clothes, paper, ink, rubber, soap, perfumes, and medicines as they are indispensable to us for proper living.

**Overview**

Inorganic chemistry is a significant branch of chemistry, crucial in many other scientific fields, comprising however not restricted to agriculture, biotechnology, microbiology, biochemistry, microbiology, botany, zoology, medicine, etc.

The course is designed to teach students the properties and reactions of inorganic compounds which includes all chemical compounds without the chains or rings of carbon including metals salts and minerals. It is fundamental to know catalysis, energy conversion and storage as they are essential to life processes in biological systems. As well as the roles of metals in microbial cells and systems and their significance.

**Objectives**

The objectives of the course are to

1. Recognize ad outline the first-row transition elements and explain their characteristics and properties
2. illustrate the crystal field theory (CFT) and draw the diagram to illustrate with examples of coordination compounds
3. state the advantages of CFT over other bonding theories
4. indicate the comparative Chemistry of the following elements. ( I) Ga, In, Tl (II). Ge, Sn, Pb
5. (III). As, Sb, Bi (IV). Se, Te, Po;
6. delineate organometallic chemistry with relevant examples with illustrations
7. sort organometallic compounds with examples;
8. organize the roles of metals in biochemical systems;
9. manage and recognize the concepts of hard and soft acids and bases.
10. outline examples of item 9 above;
11. interpret oxidation and reduction reaction; and
12. illustrate the above (11) with appropriate reactions.

**Learning Outcomes**

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

1. list the first-row transition elements and explain their characteristics and properties;
2. explain crystal field theory (CFT) and draw the diagram to illustrate with examples of coordination compounds
3. state the advantages of CFT over other bonding theories;
4. discuss the comparative Chemistry of the following elements. ( I) Ga, In, Tl (II). Ge, Sn, Pb (III). As, Sb, Bi (IV). Se, Te, Po;
5. define organometallic chemistry;
6. give relevant examples with illustrations;
7. classify organometallic compounds with examples;
8. list the roles of metals in biochemical systems;
9. discuss the concepts of hard and soft acids and bases.
10. list examples of item 9 above;
11. explain oxidation and reduction reaction; and
12. illustrate the above (11) with appropriate reactions.

**Course Contents**

Chemistry of first row transition metals. Introduction to coordination chemistry including

elementary treatment of crystal field theory. Comparative Chemistry of the following elements:

(a) Ga, In, TI, (b) Ge, Sn, Pb, (c) As, Sb, Bi (d) Se, Te, Po.

Elementary introduction to organometallic chemistry. Role of metals in biochemical systems.

Concepts of hard and soft acids and bases. Oxidation and reduction reactions

**Bayero University, Kano (BUK)**

**Faculty of Life Sciences**

**Department of Microbiology**

**B.Sc. Microbiology**

BUK-MCB 301 **Food Quality Assessment and Safety** (2CU E; LH 15; PH 45)

**Senate-approved relevance**

Training high quality graduates who are skilled and knowledgeable in design and conduct of cutting edge researches in Nigeria are in agreement with BUK's mission to address African developmental challenges in the use of microorganisms in industrial production, their roles in disease causation, new approaches in the control of microorganisms as well as their use in pollution control. Relevance is seen in Microbiologists from BUK being able to uncover microorganisms with the potential for production of food products, substances that prolong the shelf life of perishable foods and compounds with antimicrobial properties.

**Overview**

Evaluation of foods involve instrumentation as well as the use of physical and chemical techniques to evaluate food quality. Food quality includes appearance, texture and flavour which are largely subjective attributes, whereas nutritional and bacteriological quality is not. By implementing effective quality assurance protocols, one can prevent contamination to food products before final checks and allowing for a more efficient process. .

Food safety training protects people from health risks. Providing adequate food safety training to everyone who handles food is essential to protecting consumers from food poisoning, allergic reactions and other health risks that could occur from eating contaminated food**.**

**Objectives**

* 1. To identify and characterized types and agents of food spoilage and illnesses
  2. To prepare the microbiological standards and protocols in food processing chain
  3. To know both local and international agencies responsible for food quality
  4. To recognize their roles and functions local and international agencies responsible for food quality
  5. To determine Hazard and Critical Control Points (HACCP) in food production
  6. To monitor food safety management through effective tools e.g. HACCP

**Learning Outcomes**

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

* 1. describe and characterize major types and agents of food spoilage and illnesses
  2. plan the microbiological standards and protocols in food processing chain
  3. identify both local and international agencies responsible for food quality
  4. relate the roles and functions local and international agencies responsible for food quality
  5. assess Hazard and Critical Control Points (HACCP) in food production
  6. inspect food safety management through effective tools e.g. HACCP

**Course Contents**

Agents important in food spoilage, food borne illnesses (food intoxication/poisoning and food infection). Food preservation methods (physical, chemical and biological). Monitoring food quality and safety (sampling and sampling procedures, chemical and microbiological analysis). The use of indices/markers in food analysis, microbiological standards and specifications. Food plant sanitation (general cleaning and disinfection). Bacteriology of water. Food-plant water characteristics. Food solid wastes characteristics and treatment. Introduction to hazards analysis critical control point (HACCP). Agencies involved in food safety and quality management: International agencies and their functions. Nigerian agencies and their functions. Nigerian food laws.

**Bayero University, Kano (BUK)**

**Faculty of Life Sciences**

**Department of Microbiology**

**B.Sc. Microbiology**

BUK-MCB 302 **Soil and Agricultural Microbiology** (2CU C; LH 15; PH 45)

**Senate-approved relevance**

Training high quality graduates who are skilled and knowledgeable in design and conduct of cutting edge researches in Nigeria are in agreement with BUK's mission to address African developmental challenges in the use of microorganisms in agricultural production, their roles in nutrients. Relevance is seen in Microbiologists from BUK being able to uncover microorganisms with the potential for production of food and replenishment of soil quality and stability.

**Overview**

Soil Microbiology involves studying the roles of microorganisms in the soil ecosystem which include improved soil structure and soil aggregation, recycling of soil nutrients which governs nutrient processing and recycling in soil, and also affects the decomposition of organic matter in soil, soil salinity and soil acidity, thereby impacting soil fertility and crop health.

The diversity of microorganisms in the soil is important in maintaining ecological processes such as decomposition of organic matter, nutrient cycling, soil aggregation and controlling pathogens within the ecosystem.

**Objectives**

* 1. To elucidate soil properties
  2. To identify soil micro-flora
  3. To review the interaction between soil micro-flora
  4. To know the impact of human and animal activity on soil and plant micro-flora
  5. To recognize the process of biogeochemical cycles and their significance
  6. To describe decomposition of organic matter in soil
  7. To explain factors affecting the distribution of microorganisms in soil

**Learning Outcomes**

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

1. enumerate physical, chemical and biological properties of soil such as pH, temperature, nutrients, bacteria
2. illustrate soil micro-flora using techniques such as contact slide
3. compare and contrast the types of interactions between soil micro-flora such as inter- and intra-specific interaction
4. outline the process of biogeochemical cycles and their significance
5. investigate the impact of human and animal activities on soil and plant micro-flora
6. illustrate decomposition of organic matter in soil using relevant examples
7. explain factors affecting the distribution of microorganisms in soil

**Course Contents**

The soil environment: Composition, Physical, Chemical and biological properties of soil.

Microbial flora of soil environment―Bacteria, Fungi, Actinomycetes, vines, Algae and Protozoa. Microbe-plant interactions: Rhizosphere interaction, Plant growth promoting bacteria and endophytic bacteria. Positive interactions as in symbiotic Nitrogen fixation and mycorrhizal association. Soil microbes and Human health: Soil-borne pathogens and plant diseases. Soil microbes as sources of natural products for drug leads. Industrial potentials of soil microorganisms. Energy and nutrient flow. Mechanisms of dispersal of microorganisms in the environment- Passive, active mechanisms and vectors. Organic matter decomposition. Sources of organic matter. Microbial decomposers. Factors affecting organic matter decomposition and environmental significance of microbes. Biogeochemical cycling (Carbon, Nitrogen, Phosphorus, Sulphur).

**Bayero University, Kano (BUK)**

**Faculty of Life Sciences**

**Department of Microbiology**

**B.Sc. Microbiology**

BUK-MCB 303 **Biodeterioration**  (2CU C; LH 15; PH 45)

**Senate-approved relevance**

Training high quality graduates who are skilled and knowledgeable in design and conduct of cutting edge researches in Nigeria are in agreement with BUK's mission to address African developmental challenges in the use of microorganisms in industrial production, their roles in disease causation, new approaches in the control of microorganisms as well as their use in pollution control. Relevance is seen in Microbiologists from BUK being able to uncover microorganisms with the potential for production of food products, substances that prolong the shelf life of perishable foods and compounds with antimicrobial properties.

**Overview**

Biodeterioration is any undesirable change in the properties of a material caused by the vital activities of living organisms which generally affects the concrete matrix by increasing porosity, reducing strength and the cross- section area of components as well as promoting crack growth.

Biodeterioration involve physical/mechanical, soiling and fouling, assimilatory and dissimilatory processes which covers a bewildering range of all materials that can be attacked by biodeteriogens including microbial induced degradation in sewage collection systems.

**Objectives**

**(**1) To recognize the concept of biodeterioration

(2) To know the types and relevance of microorganisms involved in biodeterioration

(3) To outline the mechanisms of biodeterioration

(4) To identify the factors affecting Biodeterioration

(5) To illustrate the impact of microorganisms in biodeterioration

(6) To recognize the significance of biodeterioration

**Learning Outcomes**

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

(1) explain the concept of biodeterioration

(2) identify the types of microorganisms involved in biodeterioration

(3) illustrate the mechanisms of biodeterioration

(4) outline the factors affecting Biodeterioration

(5) assess the impact of microorganisms in biodeterioration

(6) justify the significance of biodeterioration using relevant examples

**Course Contents**

Definition of biodeterioration, Principles of biodeterioration of materials including food, fuel, paper, paints, metals, textile and leather. Factors favouring deterioration of materials. Major microbial groups involved in deterioration. Impact of processing and new technologies on biodeterioration. Biodeterioration control.

**Bayero University, Kano (BUK)**

**Faculty of Life Sciences**

**Department of Microbiology**

**B.Sc. Microbiology**

BUK-MCB 304 **Plant Microbiology**  (2CU E; LH 15; PH 45)

**Senate-approved relevance**

Training high quality graduates who are skilled and knowledgeable in skills required in processing, storage and preservation of plants and plant products in Nigeria are in agreement with BUK's mission to address African developmental challenges in the use of microorganisms in industrial production, their roles in disease causation, new approaches in the control of microorganisms as well as their use in pollution control. Relevance is seen in Microbiologists from BUK being able to determine the epidemiology and control of plant diseases.

**Overview**

The great diversity of microbes (bacteria and fungi) that can transform materials in the soil into nutrients is the key to plant survival. By providing novel nutritional and defence pathways and by modifying biochemical pathways, the plant associated micro biome can enhance or decrease species coexistence and consequently influence not only a single plant but complete ecosystems.

Plant microbiology will make it possible to understand how some microorganisms cause plant diseases, discover treatments for such diseases and even use a few microbes for industrial applications involving plant products.

**Objectives**

(1) To identify microorganisms associated with plants

(2) To determine relationship between microorganisms and plants

(3) To possess skills in processing, storage, preservation of plants

(4) To state the application of useful plant products

(5) To determine the epidemiology of plant disease

(6) The know the different ways of controlling plant diseases

**Learning Outcomes**

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

1) identify microorganisms associated with plants

(2) determine relationship between microorganisms and plants

(3) possess skills in processing, storage, preservation of plants

(4) describe the application of useful plant products

(5) explain the epidemiology of plant disease

(6) list the ways of controlling plant diseases

**Course Contents**

Significance of plant health. Classification and identification of plant pathogenic microorganisms. Concepts, of disease, infection, Pathogenesis, host-pathogen relationship. Storage techniques of plant products (fruits and vegetables). Microbial pathogenicity and disease resistance in plants. Plant disease epidemics. Diseases of commercial and ornamental plants. Plant disease management. Pathogen-saprophyte interactions and production of plant secondary metabolites and their application, hyper-parasitism, legume-rhizobium interaction.

**Bayero University, Kano (BUK)**

**Faculty of Life Sciences**

**Department of Microbiology**

**B.Sc. Microbiology**

BUK-MCB 306 **Field Course** (2CU C; PH 90)

**Senate-approved relevance**

Training high quality graduates who are skilled and knowledgeable in design and conduct of cutting edge researches in Nigeria are in agreement with BUK's mission to address African developmental challenges in the use of microorganisms in industrial production, their roles in disease causation, new approaches in the control of microorganisms as well as their use in pollution control. Relevance is seen in Microbiologists from BUK being able to uncover microorganisms with the potential for production of food products, substances that prolong the shelf life of perishable foods and compounds with antimicrobial properties.

**Overview**

Studying the diversity of microorganisms in the environment is critical to the understanding of the functioning of an ecosystem.

Understanding the diversity of microorganisms and the role they play in the ecosystem is necessary for maintaining ecological processes such as decomposition of organic matter, nutrient cycling, sewage treatment and controlling pathogens within the ecosystem.

**Objectives**

(1) To determine the relationship between types of microorganisms

(2) To recognize the distribution of microorganisms in different environments

(3) To correlate relationship between types, population and distribution of microorganisms

(4) To state the application of microbial concepts in society

(5) To outline the application of microbial concepts in industry

**Learning Outcomes**

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

(1) explain the relationship between types of microorganisms

(2) assess the distribution of microorganisms in different environments

(3) correlate relationship between types, population and distribution of microorganisms

(4) identify the applications of microbial concepts in society

(5) justify the application of microbial concepts in society and industry

**Course Contents**

Students guided studies on the diversity and application of microorganisms in the environment (Bayero University campuses, neighbouring communities, Kano metropolis and possibly Northern Nigeria)

**Bayero University, Kano (BUK)**

**Faculty of Life Sciences**

**Department of Microbiology**

**B.Sc. Microbiology**

BUK-MCB 308 **Pharmaceutical Microbiology** (2CU C; LH 15; PH 45)

**Senate-approved relevance**

Training high quality graduates who are skilled and knowledgeable in trials, tracking environmental microorganisms that are either resistant or able to produce substances with antimicrobial properties in Nigeria are in agreement with BUK's mission to address African developmental challenges in the use of microorganisms in industrial production, their roles in disease causation, new approaches in the control of microorganisms as well as their use in pollution control. Relevance is seen in Microbiologists fro BUK being able to uncover occurrence and distribution of antibiotic resistance and new products with antimicrobial activities.

**Overview**

Pharmaceutical microbiology provides knowledge and understanding of the significance of bacteria, yeasts, moulds, viruses and toxins in pharmaceutical raw materials, intermediates, products and pharmaceutical production environments, as well as the microbiological control of diseases.

It involves laboratory analysis and monitoring of microbial cultures, samples and new drugs using specialist computer software and a range of identification methods and clinical trials. It includes planning and carrying out trials, tracking environmental microorganism development.

**Objectives**

(1) To discuss different types of antibiotics

(2) To outline the classification of antibiotics

(3) To state the modes of action of antibiotics

(4) To identify the challenges of antibiotics therapy

(5) To apply the prospects of antibiotics in present era

(6) To explain the procedures employed in antibiotic/drug assay

**Learning Outcomes**

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

(1) list the types of antibiotics

(2) classify different antibiotics

(3) explain the modes of action of antibiotics

(4) describe the challenges of antibiotics therapy

(5) outline the prospects of antibiotics in present era

(6) explain the procedures employed in antibiotic/drug assay

**Course Contents**

Introduction to antibiotics and therapeutic agents. Chemical characteristics, modes of actions and therapeutic applications of various classes of antibiotics and chemotherapeutic agents. Major categories of therapeutic agents: antibacterial, anti-fungal, anti-viral and anti-parasitic agents. Resistance to antimicrobial agents: mechanisms of resistance to antibiotics and other chemotherapeutic agents. Laboratory methods for determination of antibiogram. Sources of natural products with antimicrobial properties. Basic

Pharmacodynamics and pharmacokinetics.

**Bayero University, Kano (BUK)**

**Faculty of Life Sciences**

**Department of Microbiology**

**B.Sc. Microbiology**

BUK-MCB 401 **Aquatic Microbiology** (2CU C; LH 15; PH 45)

**Senate-approved relevance**

Training high quality graduates who are skilled and knowledgeable in water quality index parameters and processes involved in explain sewage treatment in Nigeria are in agreement with BUK's mission to address African developmental challenges in the use of microorganisms in industrial production, their roles in disease causation, new approaches in the control of microorganisms as well as their use in pollution control. Relevance is seen in Microbiologists from BUK being able to ensure water quality and improvement in public health.

**Overview**

Aquatic microbiology will explore the diversity of microorganisms in fresh or salt water systems which includes microscopic plants, animals, bacteria, viruses and fungi, monitoring their behaviour and elation with other organisms in aquatic environment. It will unravel the variations among microorganisms in freshwater, estuarine and oceanic ecosystems, paving the way for understanding the role of microorganisms in ecosystems which are key to earth’s biogeochemical cycles.

Aquatic microbes are genetically, physiologically and ecologically diverse and exhibit many different patterns of evolution, adaptation and physiological responses. Microorganisms are critically important for ecological processes in aquatic environments. Bacteria and viruses are key components of the microbial loop and are central for biogeochemical cycles in aquatic ecosystems.

**Objectives**

(1) To discuss the ecology of aquatic system

(2) To review water quality index parameters

(3) To write the processes involved in sewage treatment

(4) To outline sewage disposal methods

(5) To report impact of water quality to public health

**Learning Outcomes**

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

(1) explain the ecology of aquatic system

(2) identify water quality index parameters

(3) outline the processes involved in sewage treatment

(4) discuss sewage disposal methods

(5) describe the impact of water quality to public health

**Course Contents**

Ecology of fresh and salt water. Water pollution and self-purification. Microbiology of water supply, disease transmission, water treatment and public health. Microbiology of waste disposal including sewage treatment and disposal. Biological and chemical oxygen demand tests for sewage and water.

**Bayero University, Kano (BUK)**

**Faculty of Life Sciences**

**Department of Microbiology**

**B.Sc. Microbiology**

BUK-MCB 403 **Introduction to Research Methods and Bioinformatics** (2CU C; LH 15; PH 45)

**Senate-approved relevance**

Training high quality graduates who are skilled and knowledgeable in identifying purpose, ethics and types of researches in Nigeria are in agreement with BUK's mission to address African developmental challenges in the use of microorganisms in industrial production, their roles in disease causation, new approaches in the control of microorganisms as well as their use in pollution control. Relevance is seen in Microbiologists from BUK being able to write good research proposal and conduct cutting edge researches with the view to uncover microorganisms with the potential for production of food products, substances that prolong the shelf life of perishable foods and compounds with antimicrobial properties.

**Overview**

Introduction to research methods offers students the opportunity to learn the various aspects of the research process, framing useful research questions, research design, data collection, presentation, analysis and report writing. Research methods in microbiology involve some of the research methods used in microbiology. Students will be presented with a series of research problems in the areas of microbial biotechnology, antimicrobial resistance and drug discovery and microbial ecology and biodiversity.

It is important in the development of most of molecular techniques that are now used to study organisms from microbes to humans. Biotechnology, synthetic biology, the production of therapeutic proteins, and many medical diagnoses are all dependent on these molecular tools

Bioinformatics involve automation of the genome sequencing, automated development of integrated genomics and proteomics databases, automated genome comparisons to identify the genome function, automated derivation of metabolic pathways, gene expression analysis to derive regulatory pathways.

**Objectives**

(1) To describe purpose, ethics and types of research

(3) To be able to paraphrase

(4) To manage different sampling techniques

(5) To be able to undertake appropriate data presentation and analysis

(6) To expose students to the application of computer in research (statistical soft wares, excel, referencing methods) etc.

(7) To write a good research proposal

(8) To identify the components literature review

(9) To apply reference managers and plagiarism checkers

10. To solve the basic concept of bioinformatics

11. To report the types and application of biological data bases

**Learning Outcomes**

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

(1) explain the purpose, ethics and types of research

(3) compose and paraphrase

(4) identify different sampling techniques

(5) manage appropriate data presentation

(6) analyze data appropriately

(7) write a good research proposal

(8) compose literature review

(9) use reference managers and plagiarism checkers

(10) explain the basic concept of bioinformatics

(11) compare and contrast the types and applications of biological data bases

**Course Contents**

Definition of research. Types and purpose of research, academic and scientific writing. Problems encountered by researchers. Ethical issues in research. How to write a research proposal, components of research proposal, types and use of search engines, literature review, sampling techniques, presentation of data (pie chart, bar chart, histogram, tables, graphs), descriptive and inferential statistical tools, abstracting and referencing, plagiarism and plagiarism checks. Reference managers (Endnote, Mendeley etc.). Application of computer in research, Introduction to bio informatics basic bioinformatics tools. DNA & protein sequence analysis.

**Bayero University, Kano (BUK)**

**Faculty of Life Sciences**

**Department of Microbiology**

**B.Sc. Microbiology**

BUK-MCB 404 **Analytical microbiology and quality control** (2CU C; LH 15; PH 45)

**Senate-approved relevance**

Training high quality graduates who are skilled and knowledgeable in identifying standard laboratory practice and identify standard laboratory practices in Nigeria are in agreement with BUK's mission to address African developmental challenges in the use of microorganisms in industrial production, their roles in disease causation, and new approaches in the control of microorganisms as well as their use in pollution control. Relevance is seen in Microbiologists from BUK being able to undertake microbiological, pharmaceutical, immunological clinical and diagnostic laboratories procedures.

**Overview**

Analytical Microbiology and quality control focuses on the processes, methodologies, developments, and approaches involved in determining microbiological, antibiotic, amino acid assays and dilution methods. Analytical microbiology plays an important role in biomedical research, for example, in the development of vaccines and treatments for different diseases.

There are many environmental applications for microbiology, including the use of microorganisms in bioreactors and for the degradation of oil spillages to prevent ecological damage. Quality control (QC) is one of the most important impacts on laboratory testing—it ensures both precision and accuracy of patient sample results. The integrity of quality control samples is important to both management of overall quality as well as to meeting requirements of proficiency testing.

**Objectives**

(1) To recognize concepts standard operating practices (SOP),

(2) To identify standard laboratory practices (SLP) and quality control

(3)To interpret the techniques of quality control in microbiological, pharmaceutical, immunological clinical and diagnostic laboratories

(4) To carry out the maintenance of cultures

(5) To be able to set up and keep stock culture

**Learning Outcomes**

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

(1) explain concepts standard operating practices (SOP),

(2) identify standard laboratory practices (SLP) and quality control

(3) plan the techniques of quality control in microbiological, pharmaceutical, immunological clinical and diagnostic laboratories

(4) compose the maintenance of cultures

(5) synthesize and keep stock culture

**Course Contents**

Quality control in microbiology laboratory. Good Laboratory Practices. Standard Operating Procedures (SOP). Health problem, statistical methods and sensory evaluation in quality control. Standards and specifications. Quality control of water, foods, beverages and pharmaceuticals. Quality control of techniques in immunology (Serology, Chromatography, immunophoresis, immunodiffusion etc.).Factors affecting the quality of the various facets of clinical diagnostic bacteriology**.** Quality control of commercially prepared bacteriological media. Maintenance and use of stock cultures.Control of microbiological *in-vitro* diagnostic reagents**.** Quality control in sterilization procedures and of antibiotic susceptibility discs.