**BAYERO UNIVERSITY, KANO (BUK)**

**LIFE SCIENCES**

**PLANT BIOLOGY**

**B. Sc. BIOTECHNOLOGY**

**PROPOSED 30% ADDITION TO THE CCMAS COURSE STRUCTURE AND SUMMARY**

**Level 100**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Course Code** | **Course Title** | **Unit(s)** | **Status** | **LH** | **PH** |
| BUK-BTG 106 | Careers in Biotechnology | 2 | C | 15 | 45 |
|  | **Total** | **02** |  |  |  |

**Level 200**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Course Code** | **Course Title** | **Unit(s)** | **Status** | **LH** | **PH** |
| BUK-MCB 233 | Biorisk Management | 2 | C | 15 | 45 |
| BUK-BIO 201 | Genetics I | 2 | C | 30 | - |
| BUK-BIO 203 | General Physiology | 2 | C | 30 | - |
| BUK-BIO 204 | Biological Technique | 2 | C | 30 | - |
| BUK-CHM 211 | Organic Chemistry | 3 | C | 45 | - |
| BUK-CHM 213 | Analytical Chemistry | 3 | C | 45 | - |
| BUK-BIO 299 | Industrial Attachment | 3 | C | - | - |
|  | **Total** | **17** |  |  |  |

**Level 300**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Course Code** | **Course Title** | **Unit(s)** | **Status** | **LH** | **PH** |
| BUK-BCH 301 | Enzymology | 2 | C | 30 | - |
| BUK-BTG 307 | Introduction to Food and Nutrition | 2 | C | 30 | - |
| BUK-BTG 308 | Development and Conservation of Natural Resources | 2 | C | 30 | - |
|  | **Total** | **06** |  |  |  |

**Level 400**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Course Code** | **Course Title** | **Unit(s)** | **Status** | **LH** | **PH** |
| BUK-BOT 406 | Plant Pathology | 3 | C | 30 | 45 |
| BUK-BTG 408 | Metabolic Engineering | 2 | C | 30 | - |
| BUK-BTG 409 | Intellectual Property Rights | 2 | C | 30 | - |
| BUK-BTG 410 | Analytical Methods in Microbiology | 2 | C | 15 | 45 |
| BUK-BTG 411 | Process Biotechnology | 2 | C | 30 | - |
|  | **Total** | **11** |  |  |  |
| **Grand Total** | | **36** |  |  |  |

**Bayero University, Kano (BUK)**

**Life Sciences**

**Plant Biology**

**B.Sc. Biotechnology**

**BUK - BTG 106 – Careers in Biotechnology (2 Units Core: LH 15, PH 45)**

**Senate-approved relevance**

The sum of integrated activities through creating, developing and ultimately commercializing biotechnology product through the melding of both scientific and business disciplines among the community is in agreement with Bayero University vision and mission of leading in research and education as well as addressing African developmental challenges through cutting – edge research, knowledge transfer and training of high-quality graduates who can compete in the global job market.

**Overview**

The course “Entrepreneurship in Biotechnology” is designed to produce graduates with competence to apply skills learned in enhancing scope in the areas in which the economy is highly dependent, especially in crops and animals’ production, energy security, healthcare and environment related fields.

The course will also generate in students, an appreciation of the importance of Biotechnology in an agricultural, socio-economic, environmental and technological development.

**Objectives**

The objectives of the course are to:

1. Train students on various business opportunities in biotechnology.
2. Teach students about the steps involved in the production of artificial food sweeteners, genetically modified food processing, vegetable processing plants.
3. Train students on the processes involved in waste water treatment plant, soil water quality testing, water extractors, biodegradable plastic production and biodiesel production.
4. Expose students to the importance and processes involved in the Bio-pesticides manufacturing, agri-clinic, compost fertilizer production, vermicom post, plant protection, seed processing, animal feed manufacturing, bee keeping (apiculture), bind hatchery, fish hatchery, liquid fertilizers.
5. Guide students on the techniques of biodiesel production techniques in arid zones.

**Learning outcomes**

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

1. State at least five business opportunities of biotechnology in agriculture
2. Explain the processes involved in the production of at least three (3) food products.
3. Distinguish between at least three methods of waste water treatment plant, soil water quality testing, water extractors and biodegradable plastic production.
4. Explain the impact of biotechnology in Bio-pesticides manufacturing, agri-clinic, compost fertilizer production, vermicom post, plant protection, seed processing, animal feed manufacturing, bee keeping (apiculture), bind hatchery, fish hatchery, liquid fertilizers, e.t.c.
5. Identify five ways on how biotechnology can be employed in energy generation e.g biodiesel production.

**Course contents**

Biotechnology as a course; Applications of Biotechnology; Biotechnology business opportunities in: Bio-pesticides manufacturing; agri-clinic; compost fertilizer production; vermicompost; plant protection; seed processing; animal feed manufacturing; bee keeping (apiculture); bind and hatchery; liquid fertilizers; Specialty medicine and vaccine manufacturing; consultancy services; artificial human part production (artificial limbs); medical transportation services; food supplements and blood bank; Artificial food sweeteners; genetically modified food processing; vegetable processing plants; Waste water treatment plant; soil water quality testing; water extractors; biodegradable plastic production; biodiesel production.

**Bayero University, Kano (BUK)**

**Life Sciences**

**Plant Biology**

**B.Sc. Biotechnology**

**BUK-MCB 233 – Biorisk Management (2 Units Core; 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 Biotechnology 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 Biotechnology students with the knowledge and skills on principle of biosafety and biosecurity frameworks.

The course is also 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**

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 contents**

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)**

**Life Sciences**

**Plant Biology**

**B.Sc. Biotechnology**

**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)**

**Life Sciences**

**Plant Biology**

**B.Sc. Biotechnology**

**BUK-BIO 203: General Physiology (2 Units C: LH 30)**

**Senate approved relevance**

Training of highly skilled graduate with adequate knowledge in understanding the effects of environmental change on local and large-scale ecological health is in line with BUK‘s mission to address African challenges in producing competent graduates in natural and health sciences. Relevance is seen in Biotechnology graduates from BUK being able to regulate the plants' disease, other physiological disturbances and improve crop production as well as the quality of food.

**Overview**

The need for producing graduates of Biotechnology with competence and skill in the mechanisms of living things, from the basis of cell function at the ionic and molecular level to the integrated behavior of the whole body and the influence of the external environment highlights the importance of general physiology as a course.

The course is designed to expose students to various functions can be investigated at the level of cells, tissues, organ systems and the whole body. The underlying goal is to explain the fundamental mechanisms that operate in a living organism and how they interact. The course will also build the capacity of the students in area of physiology and provide them with skills they require to respond to challenges in basic and applied sciences.

**Objectives**

The objectives of the course are to:

1. Expose students to the chemistry of organic compounds and their biological importance;
2. Teach students general characteristics of enzymes;
3. Guide students on nutrition, digestion and absorption in plants and animals;
4. Tutor students on the cell membrane structure and list its functions;
5. Teach students summarize osmoregulation, excretion and transport in animals
6. Train students on how growth hormones in plants functions;
7. Educate students on the homeostasis, their coordination and functions in animals; and
8. Prepare students on plant water relation, growth and growth regulation.

**Learning Outcomes**

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

1. Explain the chemistry of organic compounds and their biological importance;
2. State the general characteristics of enzymes;
3. Describe nutrition, digestion and absorption in plants and animals;
4. Discuss the cell membrane structure and list its functions;
5. Summarize osmoregulation, excretion and transport in animals
6. Enumerate growth hormones in plants and their functions;
7. Explain the homeostasis, their coordination and functions in animals; and
8. Explain the plant water relation, growth and growth regulation.

**Course Contents**

Chemicals of life: the chemistry of carbohydrates, lipids, proteins and nucleic acids and their biological importance. General characteristics of enzymes. Nutrition. digestion and absorption in plants and animals. Biosynthesis, photosynthesis and protein synthesis. Cell membrane structure and function. A general study of osmoregulation, excretion, transport. growth hormones and enzymology. homeostasis and their co-ordination in animals. Plant water relation. growth and growth regulation.

**Bayero University, Kano (BUK)**

**Life Sciences**

**Plant Biology**

**B.Sc. Biotechnology**

**BUK -BIO 204: Biological Techniques (2 Unit C: LH 15; PH 45)**

**Senate approved relevance**

Familiarizing methods or procedures that are used to study living things which include experimental and computational methods, approaches, protocols and tools for biological research is very relevant in training of highly skilled graduate who may have adequate knowledge. The course is in line with BUK‘s mission to address African challenges in producing competent graduates in natural and health sciences.

**Overview**

It is pertinent to produce graduates of Biotechnology with competence in use of techniques in biological sciences. The course is designed to expose students to various methods or procedures that are used to study living things.

The course introduces some basic research techniques in biological sciences, these includes Spectrophotometry, Chromatography, Manometry, Isotope methods, advanced microscopy (Scanning Electron Microscopy, Transmission Scanning Electron Microscopy, Fluorescence Microscopy); Micrometry, use of microtome; Permanent slides preparation, Plant tissue culture techniques, Sterilization & Culture techniques. Use of Counting chambers (eg hemocytometer, Sedgewick/Rafter cells and electronic particle counter, etc)..

**Objectives**

The objectives of the course are to:

1. Guide students on the use of different parts of a light microscope and state their functions;
2. Train students on the stages involved in preparation of slides;
3. Expose students to basic principles of spectrophotometry, colorimetry, photometry;
4. Teach students polarimetry, chromatography, refractometry, melting points and colligative properties;
5. Train students on the basic collection and preservation processes of plant and animal materials and their preservation in herbarium and museum respectively; and
6. Tutor students on the need for experimental design, basis of report writing and presentations.

**Learning Outcomes**

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

1. List the different parts of a light microscope and state their functions;
2. State and explain the stages involved in preparation of slides;
3. Describe the basic principles of spectrophotometry, colorimetry, photometry;
4. Describe polarimetry, chromatography, refractometry, melting points and colligative properties;
5. Describe the basic collection and preservation processes of plant and animal materials and their preservation in herbarium and museum respectively; and
6. Explain the need for experimental design, basis of report writing and presentations.

**Course Contents**

Microscopy. handling of microscopes. preparation of microscope slides (microtomy) for microscopic examinations. use of hand lens. biological drawings and diagrams. Spectrophotometry. Colorimetry. Photometry. Polarimetry. Chromatography. Refractometry. melting points and colligative properties. Herbarium and museum techniques. Experimental designs, report writing and presentations.

**Bayero University, Kano (BUK)**

**Life Sciences**

**Plant Biology**

**B.Sc. Biotechnology**

**BUK -CHM 211: Organic Chemistry I (2 Units C: LH 30)**

**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. Biotechnology 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, 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)**

**Life Sciences**

**Plant Biology**

**B.Sc. Biotechnology**

**BUK -CHM 213: Analytical Chemistry I (2 Units C: LH 30)**

**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. Biotechnology students that play an important role in measuring simple medical tests like serum cholesterol, urine ketones, and blood glucose level, Analytical techniques also help in determining the levels of toxic waste in the body like uric acid, cholesterol, drugs and some salts.

**Overview**

Organic chemistry is the chemistry that detects, identifies, characterizes, and quantifies chemical compounds in a given sample. The course will therefore, aid Biotechnology students in use of various chemical reactions and techniques to identify the analyte and determine how much of it is present in a given sample.

The course is also designed to expose students to aid forensic investigations. Some of the common forensic tests that involve analytical techniques are DNA analysis, forensic pathology, drug analysis, and trace evidence examination.

**Objectives**

The objectives of the course are to:

1. Expose students to analytical processes which include description of chemist as a problem solver;
2. Teach students forms of error;
3. Guide students on the forms of error and its implication on laboratory analysis;
4. Train students on the use of different statistical tool use in treatment of data;
5. Expose students to practical problems solving using the statistical tools;
6. Tutor students field work samplings;
7. Guide students on different forms of sample collection and processing;
8. Expose students to volumetric method of analysis and solve some practical problems; and
9. Prepare students on gravimetric method of analysis and solving of some practical problems.

**Learning Outcomes**

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

1. Explain analytical processes which include description of chemist as a problem solver;
2. Describe and differentiate forms of error;
3. Explain its implication on laboratory analysis;
4. State different statistical tool use in treatment of data;
5. Solve practical problems using the statistical tools;
6. Define sampling and give reasons for sampling in field work;
7. State and describe different sampling techniques;
8. State different forms of sample collection and processing;
9. Describe volumetric method of analysis and solve some practical problems; and
10. Describe gravimetric method of analysis and solve some practical problems.

**Course Contents**

Theory of errors; and statistical treatment of data: Theory of sampling. Chemical methods of analysis including volumetric, gravimetric, data analysis and presentation; Physicochemical methods, Optical methods of analysis; separation methods. The Analytical Process; Chemical Measurements; Experimental Error; Chemical Equilibrium; Activity and the Systematic Treatment of Equilibrium; Monoprotic Acid-Base Equilibria; Polyprotic Acid-Base Equilbria; Acid-Base Titrations; Fundamentals of Electrochemistry; Electrodes and Potentiometry; Redox Titrations; Electroanalytical Techniques; EDTA Titrations; Gravimetric Analysis; Precipitation Titrations; Combustion Analysis; Advanced Topics in Equilibrium

**Bayero University, Kano (BUK)**

**Life Sciences**

**Plant Biology**

**B.Sc. Biotechnology**

**BUK -BTG 299: Industrial Attachment (12 Weeks) (3 Units C: PH 135)**

**Senate approved relevance**

Training programme designed to expose and prepare students of universities and other tertiary institutions for the Industrial Work situation they are likely to meet after graduation is in line with BUK‘s mission to address African challenges in producing competent graduates in natural and health sciences.

**Overview**

The course is created as a scheme that is aimed at exposing Biotechnology students to machines and equipment, professional work methods and ways of safeguarding the work areas and workers in industries, offices, laboratories, hospitals, and other organizations.

The course is also designed to ensure that relevant stakeholders must be committed to the course and be fully involved, which means students and teachers form institutions of higher learning, corporate industries and commercial bodies, and Federal Government must be involved.

**Objectives**

The objectives of the course are to:

1. Provides the avenue for students in institutions of higher learning to gain industrial skills and experiences in their course of study.
2. Prepare the students for the industrial work situation they’re likely to meet after graduation.
3. Expose students to work method and techniques in handling equipment and machinery that may not be available in their institutions.
4. Educate students on the transition from school to the world of work
5. Provides students with an opportunity to apply their knowledge in actual work situations, bridging the gap between theory and practice.
6. Enlist and strengthen employers’ involvement in the entire educational process and prepare students for employment after graduation.

**Learning Outcomes**

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

1. Gain industrial skills and experiences in Biotechnology.
2. Prepared for the industrial work situation they’re likely to meet after graduation.
3. Get exposed work method and techniques in handling equipment and machinery that may not be available in their institutions.
4. Make the transition from school to the world of work easier and enhance students’ contact for later job placement.
5. Get opportunity to apply their knowledge in actual work situations, bridging the gap between theory and practice.
6. Enlist and strengthen employers’ involvement in the entire educational process and prepare students for employment after graduation.

**Course Contents**

Students should be attached to relevant industrial organizations for 12 Weeks preferably during the long vacation for appropriate experience. Students should be assessed based on seminar presentations, written reports and supervisors’ assessments.

**Bayero University, Kano (BUK)**

**Life Sciences**

**Plant Biology**

**B.Sc. Biotechnology**

**BUK - BTG 301 – Enzymology (2 Units Core: LH 30**)

**Senate approved relevance**

Training of highly skilled graduate with adequate knowledge in enzymology and application enzyme technology to solve problems in critical areas like food, health and environment is in line with BUK‘s mission to address African challenges in producing competent graduates in natural and health sciences. Relevance is seen in Biotechnology graduates from BUK being able to employ enzyme technology to initiate research or industrial career (food, pharmaceutics or biotechnology) with impact in our daily life.

**Overview**

Enzymes are used in making cultures, development of medicines, processing of food, food preservation, diseases diagnosis, biofuel and environmental processes. This highlight the need for producing graduates of Biotechnology with competence and skill on the use of enzymes to solve problems and create new technologies.

The course is designed to expose students to various applications of enzyme technology in production, health and environment. The course will also build the capacity of the students in area of enzymology and provide them with skills they need to respond to challenges in basic and applied sciences. The is fundamental in developing new generation of scientists that have the capacity for critical analysis of scientific phenomena involving enzymes and competently work with enzyme systems to proper solutions to emerging problems in life sciences.

**Objectives**

The objectives of the course are to:

* + - 1. Teach students about classification and nomenclature of enzymes.
      2. Provide student with basic knowledge on structure of vitamins and role of co-enzymes in enzyme biochemistry.
      3. Equip students with basic knowledge on the genetics of enzyme
      4. Educate students on mechanism of action of enzymes
      5. Educate students on the roles of physical conditions such as temperature, pH, ions and inhibitors on enzyme activities.
      6. Teach students significance of Michaelis-Menten equation.
      7. Guide students on the procedures of Production, isolation, purification and characterization of enzymes

**Learning outcomes**

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

* + - 1. Demonstrate basic knowledge on the different types and nomenclature of enzymes.
      2. Demonstrate clear understanding of the biochemistry of some groups of enzymes and co-enzymes.
      3. Discuss the genetic origin of enzymes.
      4. Describe the roles of at least five environmental conditions on activities of enzyme
      5. Describe and use the equations of enzyme kinetics
      6. Describe the catalytic mechanisms employed by well-characterized enzymes and mechanisms of enzyme regulation.

**Course contents**

Discovery, classification and nomenclature of enzymes; Vitamins and co-enzymes; minerals in enzyme biochemistry; Fat and water soluble vitamins; Structures and functions of vitamins and co-enzymes; Genetics of enzymes; Enzyme inhibition; Mechanisms of enzyme-catalysed reactions; Effects of temperature, pH, ions and inhibitors on enzyme catalysed reactions; Derivation and significance of Michaelis-Menten equation; Allosteric/Regulatory enzymes; Active sites of enzymes; Estimation of kinetic parameters of enzyme activities; Zymogen activation, digestive enzymes etc.; Production, isolation, purification and characterization of enzymes; Recent advances in enzymology.

**Bayero University, Kano (BUK)**

**Life Sciences**

**Plant Biology**

**B.Sc. Biotechnology**

**BUK-BTG 307: Introduction to Food and Nutrition (2 Units Core: LH 30)**

**Senate approved relevance**

The mission of BUK is to address African challenges in producing competent graduates in natural and health sciences. Training competent graduates with requisite training in nutrition is in line with this mission. Nutrition is an important integral component of any health delivery system. Nutrition and health are intricately related therefore, addressing nutrition problems plays a key role in most public health programs. Graduates of Biotechnology other related disciplines with strong background in the core concepts of nutrition as well as its linkage to public health will play a key role in addressing health challenges in arid and semi-arid region of Nigeria

**Overview**

General nutrition is design to educate students in Biotechnology programme on various food types and the role they play in our heath. The students are expected to have a clear understanding of the challenges that exist in nutrition and its implication in the health delivery.

The course is expected to expose students to new frontiers in nutrition and learn how to apply nutrition principles in choice of food choices and understand how food components such as carbohydrates, lipids, proteins, vitamins, minerals, and water affect health, disease, energy balance, and weight control. The course will expose students to nutritional disorders their prevention and control as well as nutritional status and requirements. The course will educate students on nutrients requirements as it’s relate to physical activity and ageing as well as diet and disease, obesity and under nutrition.

**Objectives**

The objectives of the course are to:

1. Introduce students to various methods of determining food constituents
2. Educate students on scientific facts on nutrition and its relation with health
3. Expose students to various methods of food processing, preservation and storage
4. Introduce students to various ways of preventing and curing food poisoning and food intoxication.
5. Educate students on nutritional value and energy value of foods
6. Teach students the concepts of energy balance and weight control
7. Equip students with knowledge of the different nutritional disorders and their implications in human health.

**Learning outcome**

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

1. Demonstrate considerable capacity in at least three methods of evaluation of food constituents
2. Explain the relationship between diet and health
3. Explain the at least three methods of processing, preserving and storage of different food types
4. Discuss three dangers associated with consumption of contaminated food.
5. Carry out critical analysis of nutritional and energy value of at least three classes of foods
6. Describe at least five nutritional disorders and their health implications

**Course contents**

An introduction to the theory and application of physical and chemical methods for determining the constituents of food; Food processing, preservation and storage of traditional foods – root and stem tubers, fruits and fruit drinks, seeds and grains, greens and vegetables; Food poisoning and intoxication; prevention and cure; Food nutrients; Energy values of foods and energy expenditure by mammalians; Nutritive value of foods - carbohydrates, fats, proteins, vitamins, mineral elements and water; Nutritional disorders, prevention and therapy; Nutritional status and nutritional requirements; Recommended dietary allowances; Assessment of nutritional status; Nutrient requirements in relation to physical activity and ageing, diet and disease, obesity and under nutrition.

**Bayero University, Kano (BUK)**

**Life Sciences**

**Plant Biology**

**B.Sc. Biotechnology**

**BUK-BTG 308: Development and Conservation of Natural Resources (2 Units Core: LH 30)**

**Senate approved relevance**

Training students with adequate skills in bioresources development and efficient use of natural resources to achieve sustainable development is in line with millennium development goals especially under the current threats by global warming. This is also in line with BUK’s mission of generating skilled manpower that ensures sustainable utilization and conservation of natural resources in Africa. Graduates of Biotechnology from BUK with requisite knowledge and skills in Bioresources Management will facilitate sustainable utilization natural of resources. Development of modern crops and technologies in renewable energy that respond to the challenges of global warming and other extreme weather conditions will ensure sustainable utilization and conservation of natural resources.

**Overview**

Development and conservation of natural resources is design to educate students on the biological diversity at species level and the genetic bases of plant diversity, how combination of genes and their associations control diversity.

The course will educate students on the evolution of cultivated plants from the wild type and the role of genetic diversity in the evolution of cultivated plant species. Genetic hybridization and its role in the improvement of cultivated plants, genetic erosion and its causes as well as the effect of genetic erosion on biodiversity. Over exploitation of biological resources, conservation strategies and how conservation influences the retention of genetic diversity. Development of seed banks and its maintenance as well as collection of seed from local plant species for seed bank establishments, biotechnology alternative to use of animals in experimentation and its role in the protection of forest and economic plant species.

**Objectives**

The objectives of the course are to:

1. Educate students on the biodiversity at family and species levels
2. Educate students on linkage between genetic makeup of organisms and diversity among populations
3. Expose students to various hybridization techniques and the role genetic diversity play in hybridization
4. Educate students on the genetic erosion and loss of genetic biodiversity
5. Guide students on the various ways through which genetic diversity is lost
6. Teach students various conservation techniques
7. Educate students on the role of conservation in maintenance and improvement of plant and animal genetic resources
8. Expose students to germplasm collection and establishment of seed banks
9. Educate students on the role of biotechnology on the conservation of Animal resources
10. Educate students on the role of biotechnology on the conservation of plant resources with emphasis on forest and cultivated species
11. Educate student patent and rights of plant and animal breeders

**Learning outcomes**

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

1. Demonstrate significant level of understanding of the genetic diversity and its scientific bases at two hierarchies.
2. Explain the genetic bases of hybridization
3. Demonstrate good skills in hybridization and explain the significance of genetic diversity in hybridization
4. Demonstrate considerable knowledge on genetic erosion and at least five implications on biodiversity
5. Demonstrate at least five skills on germplasm collection and conservation
6. Discuss the five roles of biotechnology in plant and animal conservation
7. Understand patents and the rights of breeders

**Course contents**

Biological diversity, genetic diversity, specific diversity; species of local cereals,; local legume species, local fruit tree species. Genetic diversity expressed through large number of associations or combinations of genes in individuals of single species. Wild local plants related to cultivated species and whose genetic diversity is crucial ingredient to co-breeding or hybridization processes aimed at giving more vigour to the crop varieties that have been cultivated over so many years. Loss of genetic variability of crops or genetic erosion; species disease resistance, utilization of plant and animal genetic resources, local germplasms. Conservation of plant and animal genetic resources, the effects of destruction of natural environment on local plant and animal genetic resources. The importance of conserving the biological heritage of plant and animal kingdoms. Development of seed and gene banks, modes of operation of gene banks, germplasm collections of local crop species, gene banks and breeding. Selection of resistant varieties, biotechnologically-based alternatives to live animal experiments; biotechnological protection of forest plantations and economic plants, germplasm appropriation and privatization for crop improvement. Patents and plant breeders’ rights, production of improved plants and animals.

**Bayero University, Kano (BUK)**

**Life Sciences**

**Plant Biology**

**B.Sc. Biotechnology**

**BUK -BOT406: Plant Pathology (3 Units C: LH 30; PH 45)**

**Senate approved relevance**

Training students with adequate skills in investigation of the biotic and abiotic factors behind the failure of plants to reach their genetic potential, and develops interventions to protect plants, reduce crop losses and improve food security is also in line with BUK’s mission of generating skilled manpower that ensures sustainable utilization and conservation of natural resources in Africa.

**Overview**

The course is created to propose advanced techniques that can be used to protect crops from losses due to diseases. The science of plant pathology has contributed disease free certified seed production. Most of the diseases with known disease cycle can now be avoided by the modification of some practices.

The course also was designed to produce interest in students towards studying several of the thousands of diseases of crop plants and work to limit the damage caused by these infectious agents through biotechnology.

**Objectives**

The objectives of the course are to:

Teach students principles and concept in plant pathology;

1. Introduce students to disease infection;
2. Guide students to design of disease triangle and its relation to pathogenicity;
3. Expose students to biological and chemical control of diseases;
4. Prepare students on the method of studying plant diseases;
5. Educate students about the parasitic and non-pathogenic diseases; and
6. Train students on how to survey diseases symptoms.

**Learning Outcomes**

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

1. Identify the principles and concept in plant pathology;
2. Explain the disease infection;
3. Design the disease triangle and its relation to pathogenicity;
4. Apply biological and chemical control of diseases;
5. Describe the method of studying nematodes;
6. Identify the parasitic and non-pathogenic diseases;
7. Appraise the methods of studying plant disease; and
8. Survey diseases symptoms.

**Course Contents**

Principles and concepts in plant pathology. The concept of disease, infection, pathogenesis, host- pathogen relationship. Methods and theory of biological therapy and chemotherapy. Disease inciting organisms. Symptoms of plant diseases. Defense mechanisms. Principles of plant disease control. Methods of studying plant diseases. Biopesticides in deceases management. The method of studying nematodes diseases of plants.

**Bayero University, Kano (BUK)**

**Life Sciences**

**Plant Biology**

**B.Sc. Biotechnology**

**BUK-BTG 408: Metabolic Engineering (2 Units Core: LH 30)**

**Senate approved relevance**

Generating graduates with valuable knowledge and toolset to address emerging problems in the field of metabolic engineering is critical to the growing biotechnology industry. This is relevant more particular in growing economies of the developing countries and in line with mission of BUK in producing skilled man power for economic development in Nigeria and African continent. Importance of this course is seen in graduates of Biotechnology from BUK with knowledge and skills of applying engineering principles to analyse, design, and modify metabolic pathways in living cells and convert raw materials to products like food, valuable chemicals and biofuels. This technology plays critical role in addressing problems in food and health sectors as well as control of environmental pollution and climate change.

**Overview**

Metabolic engineering is design to educate students on use of engineering concepts for analysis and design of cellular functions.

Students will also be educated on Regulation of metabolism, induction, nutritional repression, feedback regulation, metabolic control mechanisms; regulatory mechanism of carbohydrates metabolism; regulation of protein and amino acid synthesis; Regulation of biosynthetic pathways in prokaryotes and eukaryotes, feedback resistance mutation.

**Objectives**

The objectives of the course are to:

1. Educate students on the application of engineering concepts for analysis and design of cellular functions.
2. Educate students on regulation of metabolism in living cells
3. Expose students to metabolic control mechanisms in cells
4. Educate students on mechanism of carbohydrates metabolism and regulation of protein and amino acid synthesis
5. Educate students on Regulation of biosynthetic pathways in prokaryotes and eukaryotes
6. Educate student feedback resistance mutation.

**Learning outcomes**

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

1. Demonstrate significant skills on at least five applications of engineering concepts in metabolic engineering
2. Demonstrate clear understanding of regulation of metabolism in living cells
3. Explain three metabolic control mechanisms
4. Demonstrate considerable understanding of carbohydrates metabolism and protein synthesis.
5. Understand two metabolic pathways in prokaryotes and eukaryotes
6. Explain the genetic bases of feedback resistance

**Course contents**

Regulation of metabolism, induction, nutritional repression, feedback regulation, metabolic control mechanisms; regulatory mechanism of carbohydrates metabolism; regulation of protein and amino acid synthesis; Regulation of biosynthetic pathways in prokaryotes and eukaryotes, feedback resistance mutation.

**Bayero University, Kano (BUK)**

**Life Sciences**

**Plant Biology**

**B.Sc. Biotechnology**

**BUK-BTG 409: Intellectual Property Rights (2 Units Core: LH 30)**

**Senate approved relevance**

The vision of Bayero University is to lead in research and education in Africa. The mission of the University is to be committed to addressing African developmental challenges through cutting – edge research, knowledge transfer and training of high-quality graduates. The primary function of the University is to provide education, conduct research, create and disseminate knowledge, and community service. In carrying out these functions, intellectual property, which has both academic and economic values, are created. This course is designed with the aim of producing graduates in Biotechnology who are knowledgeable of intellectual property rights and resources with a view to conduct and manage these assets self-reliance and also to the advantage of the society at large. The University has evolved a policy on IP and it aims to encourage each faculty/institute/college and department to incorporate intellectual property as one of the compulsory/elective courses in their respective curriculum.

**Overview**

The course, Intellectual Property Resources, is designed to educate students of Biotechnology with knowledge of proprietary rights which arise under, or is capable of being obtained under legislation relating to copy rights, patents, designs or plant varieties, or which otherwise exist in law, including trade secrets, know-how and other confidential information and unregistered trademarks and trade names.

The course is also expected to inculcate knowledge of ownership of pedagogical, scholarly or artistic works, created in the course of their education, for example, thesis, dissertations, papers, and articles, and that rights to these shall remain with the creator of the work.

**Objectives**

The objectives of the course are to:

1. Educate students on the basic knowledge of Intellectual Property resources.
2. Equip students with knowledge of ownership of intellectual property.
3. Equip students with knowledge of rights and obligations of inventor/innovator/author/ researcher.
4. Guide students on the procedures for disclosure and reporting of research activities with IP potentials/ value.
5. Train students on commercializing intellectual property upon graduation.
6. Train students on procedures of ownership of innovations and/or inventions.
7. Teach students appropriate methods of dispute resolution on issues of IP rights.

**Learning outcomes**

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

1. Demonstrate basic knowledge of Intellectual Property resources;
2. Explain the concept of ownership of intellectual property;
3. Describe the concept of rights and obligations of inventor/innovator/author/ researcher;
4. Explain the procedures for disclosure and reporting of research activities with IP potentials/ value;
5. Demonstrate how to commercialize intellectual property;
6. Explain the procedures of ownership of innovations and/or inventions; and
7. Describe appropriate methods of dispute resolution on issues of IP rights.

**Course contents**

Description of Intellectual property (IP) rights; Goals, objectives and scope of IP policy in B.U.K; Coverage of the IP policy; Ownership of IP assets; Rights and obligations of inventor/innovator/author/ researcher; Disclosure and reporting of research activities with IP potentials/ value; Confidentiality; Management of IP; Research collaboration; Commercialization of intellectual property; Distribution of Income derived from the commercialization of IP assets; Ownership of innovations and/or inventions; Appropriate methods of dispute resolution on issues of IP rights.

**Bayero University, Kano (BUK)**

**Life Sciences**

**Plant Biology**

**B.Sc. Biotechnology**

**BUK-BTG 410: Analytical Method in Microbiology (2 Units Core: LH 15, PH 45)**

**Senate approved relevance**

Biotechnology graduates with hand on training on biotransformation and biodegradation will play key role pollution control through isolation and utilization of fungal and bacterial species with genetic capacity to transform waste into useful products and/or degrade non degradable wastes that are becoming a menace to our environment. This is in line with BUK’s mission of producing skilled man power that could address the increasing challenge of environmental pollution. Relevance is seen in graduates of Biotechnology from BUK applying analytical skills to address environmental problems and develop new technologies that will proper solutions to emerging problems in the field of biotechnology.

**Overview**

The course “Analytical methods in microbiology” is design to educate students on analytical instrumentation and its application in research and industry. Students will receive hands-on training in the use of analytical instrumentation and its application in microbiological research.

Students will also be train on microbial fermentation, biodegradation and biotransformation of wastes. Finally, techniques of identification of potential bacterial and fungal species useful in fermentation, biotransformation and biodegradation

**Objectives**

The objectives of the course are to:

1. Train students on the principle of operation of various instruments in microbiology laboratory.
2. Educate students on scientific principles involved microbial fermentation
3. Expose students to biodegradation and biotransformation
4. Educate students on scientific principles involved biodegradation and biotransformation of waste products
5. Guide students on the identification and isolation of bacterial and fungal species useful in fermentation, biodegradation and biotransformation

**Learning outcomes**

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

1. Express adequate skills in analytical instrumentation
2. Demonstrate clear understanding of microbial fermentation
3. Explain biodegradation and biotransformation
4. Exhibit considerable skill on the identification and isolation of bacterial a fungal species with potential for commercial application in industries
5. Discuss the procedure of identification and isolation of bacterial and fungal species useful in fermentation, biodegradation and biotransformation

**Course contents**

Hands-on training in the use of analytical instrumentation in microbiological research and applications including biotransformatics and fermentations, biodegradation and identification of bacteria and fungi.

**Bayero University, Kano (BUK)**

**Life Sciences**

**Plant Biology**

**B.Sc. Biotechnology**

**BUK-BTG 411: Process Biotechnology (2 Units Core: LH 30)**

**Senate approved relevance**

Biotechnology graduates with requisite skills in process biotechnology play critical role in food pharmaceutical, chemical and fuel industries. Graduates with valuable knowledge and skills in process biotechnology are critical to the growing biotechnology industry. This is in line with BUK’s mission of producing skilled man power to address emerging problems in fast growing biotechnology industry. Relevance of this course is seen in graduates of Biotechnology from BUK applying skills in process biotechnology for the production of food, pharmaceuticals, valuable chemicals and biofuels from bio-base raw materials. These skills are critical in ensuring sustainable utilization of natural resources.

**Overview**

Process biotechnology is design to educate students on the application of bioreactors and fermentation technology for the production of valuable products.

The course will also educate students on description of various types of vessels for cell cultivation, bioreactor design and optimization and agitation, applications of biotechnology in pharmaceutical industry and the operation of fermentation systems as well as downstream separation and purification protocols on industrial scale.

**Objectives**

The objectives of the course are to:

1. Expose students to various vessels for cell cultivation.
2. Train students on the design and optimization of bioreactor
3. Educate students on the application of biotechnology in pharmaceutical and other industries
4. Train students on the operation of fermentation system and purification protocol at industrial scale

**Learning outcomes**

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

1. Explain at least five vessels for cell cultivation.
2. Design and optimize bioreactor
3. Explain five applications of biotechnology in pharmaceutical and other industries
4. Describe operation of fermentation system and purification protocol at industrial scale

**Course contents**

Description of various types of vessels for cell cultivation; Bioreactor design and optimization; Agitation of bioreactors; Survey of the applications of biotechnology, emphasizing the pharmaceutical industry and the operation of fermentation systems; Case studies of downstream separation and purification protocols employed on an industrial scale.