**BAYERO UNIVERSITY, KANO (BUK)**

**LIFE SCIENCES**

**PLANT BIOLOGY**

**B. Sc. BOTANY**

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

**Level 100**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Course Code** | **Course Title** | **Unit(s)** | **Status** | **LH** | **PH** |
| BUK-BIO 101 | General Biology I | 2 | C | 30 | - |
| BUK-BOT 104 | Practical Botany | 2 | C | - | 90 |
| BUK-BOT 106 | Entrepreneurships in Botany | 2 | C | 30 | - |
|  | **Total** | **06** |  |  |  |

**Level 200**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Course Code** | **Course Title** | **Unit(s)** | **Status** | **LH** | **PH** |
| BUK-BIO 202 | Introductory Ecology | 2 | C | 15 | 45 |
| BUK-BOT206 | Introduction to Experimentation in Botany | 2 | C | 30 | - |
| BUK-BOT 201 | Introduction to Horticulture | 2 | C | 30 | - |
| BUK-MCB232 | Biorisk Management | 2 | C | 15 | 45 |
| BUK-BOT 208 | Practical Horticulture | 1 | C | - | 45 |
|  | **Total** | **09** |  |  |  |

**Level 300**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Course Code** | **Course Title** | **Unit(s)** | **Status** | **LH** | **PH** |
| BUK-BOT 306 | Plant Breeding | 3 | C | 15 | 90 |
| BUK-BOT 307 | Phycology | 3 | C | 15 | 45 |
| BUK-BOT 308 | Post-harvest Physiology of Fruits | 2 | C | 15 | 45 |
|  | **Total** | **08** |  |  |  |

**Level 400**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Course Code** | **Course Title** | **Unit(s)** | **Status** | **LH** | **PH** |
| BUK-BOT 402 | Economic Botany | 2 | C | 30 | - |
| BUK-BOT 408 | Plant Tissue Culture | 3 | C | 15 | 90 |
| BUK-BOT 414 | Plant Molecular Biology | 3 | C | 45 | - |
| BUK-BOT 417 | Plants and Environmental Pollution Monitoring | 3 | C | 30 | 45 |
| BUK-BOT 403 | Research Methodology | 2 | C | 15 | 45 |
|  | **Total** | **13** |  |  |  |
| **Grand Total** | | **36** |  |  |  |

**Bayero University, Kano (BUK)**

**Life Sciences**

**Plant Biology**

**B.Sc. Botany**

**BUK - BOT 104: Practical Botany (2 Units Core: PH 90)**

**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. This course is designed with the aim of producing graduates in Botany who are knowledgeable in Practical aspect of Botany, in the areas of lower and higher plants in the arid and semi-arid regions of Nigeria. The University has evolved a policy on encouraging each science oriented faculties and Departments to incorporate practical in all the levels as compulsory/elective courses in their respective curriculum.

**Overview**

The course, practical Botany, is designed to educate students of Botany with knowledge of lower and higher plants. The course is also expected to inculcate knowledge of different types of herbs, shrubs and trees in the environment.

The course is designed to introduce students to different morphological structures of leaves, stems and roots. The course will also educate students on different floral parts, types of germination and methods of breaking dormancy of some hard coat seeds in arid and semi-arid regions of Nigeria

**Objectives**

The objectives of the course are to:

1. Train students basic knowledge of practical skills in Botany;
2. Teach students types of lower and higher plants in arid and semi-arid zones of Nigeria
3. Teach students the types of leaves, stems and roots and their morphological characteristics in the area
4. Train students basic knowledge on structurers of different parts of the flowers in the area
5. Teach students types of germinations and the methods of breaking dormancy in some hard seed of indigenous plants.

**Learning outcomes**

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

1. Identify at least five common morphological features of algae, fungi, moss, ferns etc.
2. Categorize the three major plant forms: herbs, shrubs and trees around the environment.
3. Describe five anatomical structures of leaf stem and roots in angiosperm and gymnosperm.
4. Identify the two floral parts (essential and non-essential) and dissect male and female parts
5. Describe at least three stages of germination and dormancy breaking in dicot and monocot seeds as well as the two types of germination.
6. Describe at least four types of dormancy and methods of breaking seed dormancy.

**Course contents**

Study of lower plants: Thallophyta, Bryophyta, Pteridophyta, identification of plant habits: herbs, shrubs and trees, morphological examinations of leaf, stem and roots of angiosperm and gymnosperm plants; flower structures: male and female floral parts; Germination and types of germination; breaking dormancy in seeds of higher plants.

**Bayero University, Kano (BUK)**

**Life Sciences**

**Plant Biology**

**B.Sc. Botany**

**BUK - BOT 106 – Entrepreneurship in Botany (2 Units Core: LH 15, PH 45)**

**Senate approved relevance**

The 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. Entrepreneurial Botany is the study of how new businesses are created using plant resources and the actual process of starting a new business. In the present scenario, merging skills and knowledge in a meaningful way through converting botanical expertise into business ideas that can be put into practice for earning a livelihood is the focus of the course.

**Overview**

The course “Entrepreneurship in Botany” 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 mushroom and cactus cultivation, bio-pesticide and seaweed liquid fertilizer production, plant nursery, floriculture and terrarium as well as in organic farming.

The course also generates in students, an appreciation of the importance of Botany in environmental, agricultural and other socio-economic developments.

**Objectives**

The objectives of the course are to:

1. Teach students on knowledge of science of Botany and different specializations of Botany
2. Educate students on different business opportunities in botany.
3. Teach students steps involved in the cultivation of mushroom, cactus and medicinal as well as aromatic plants.
4. Teach students processes involved in bio-pesticide and seaweed liquid fertilizer production.
5. Train students on the importance and processes involved in establishment of plant nursery, floriculture and terrarium.
6. Guide students on the concept of organic farming

**Learning outcomes**

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

1. Define Botany and list at least eight areas of specialization in Botany.
2. List at least ten (10) business opportunities in botany.
3. Develop skills in steps involved in the cultivation of mushroom, cactus and medicinal as well as aromatic and other plants.
4. Develop formulations of bio-pesticide and seaweed liquid fertilizer.
5. Establish small and large scale plant nursery, floriculture and terrarium.
6. Explain the techniques in organic farming.

**Course contents**

Botany as a course; branches of Botany; Business opportunities in: Mushroom cultivation, plant nursery, herbal technology, organic farming, floriculture, cactus garden, sea weed liquid fertilizer, organic pesticides, terrarium; cultivation of medicinal, aromatic and other plants.

**Bayero University, Kano (BUK)**

**Life Sciences**

**Plant Biology**

**B.Sc. Botany**

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

**Senate approved relevance**

As a field of science, general biology helps fresh students understand the living world and the ways its many species function, evolve, and interact. The course is in line with the 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 “General Biology” as a branch of natural science that deals with the study of living things, including their origin, structure, function, maturation, evolution and classification is designed to prepare grounds for fresh students to understand Biological concept and apply its application in the various field of Botany.

The course also generates in students, an appreciation of the importance of studying various organs and sections of an animal or plant as well as understanding the mechanisms in various functions, including reproduction, metabolism, food gathering, and behavior.

**Objectives**

The objectives of the course are to:

1. Educate students on the cells structures and organizations;
2. Teach students functions of cellular organelles;
3. Acquaint students on the characteristics of living organisms and their general reproduction;
4. Expose students to different interrelationship that exists between organisms;
5. Edify students on the concept of heredity and evolution; and
6. Educate students on habitat types and their characteristics.

**Learning Outcomes**

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

1. Explain cells structures and organizations;
2. Summarize functions of cellular organelles;
3. Characterize living organisms and state their general reproduction;
4. Describe five types of interrelationship that exist between organisms;
5. Discuss the concept of heredity and evolution; and
6. Enumerate at least 3 habitat types and their characteristics.

**Course Contents**

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

**Bayero University, Kano (BUK)**

**Life Sciences**

**Plant Biology**

**B.Sc. Botany**

**BIO 202: Introductory Ecology (2 Units C: LH 15; PH 45)**

**Senate approved relevance**

Studying introductory ecology as a course enriches our world and is crucial for human wellbeing and prosperity. It provides new knowledge of the interdependence between organisms and nature that is vital for food production, maintaining clean air and water, and sustaining biodiversity in a changing climate. It is thus, in tandem with the 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**

Introductory Ecology is conceived to produce background of study of organisms, the environment and how the organisms interact with each other and their environment at various levels, such as organism, population, community, biosphere and ecosystem. The course will also improve students’ understanding of life processes, adaptations and habitats, interactions and biodiversity of organisms.

The course also generates in students, an appreciation of the importance of studying distribution of biotic and abiotic factors of living things in the environment. The biotic and abiotic factors include the living and non-living factors and their interaction with the environment.

**Objectives**

The objectives of the course are to:

1. Introduce students to various concepts and terminologies associated with the ecosystem;
2. Expose students to features of various habitat types;
3. Train students on population studies and ecological samplings,
4. Teach students natural destruction/disaster, community and natural cycles; and
5. Guide students on factors responsible for changes in population.

**Learning Outcomes**

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

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

**Course Contents**

Concept and definition of ecosystem. ecology at community level. Ecological classification of habitat types. terrestrial and aquatic biomass. Specific features of each, biotic components of habitat. Natural destruction. factors of communities, success of community interaction. Natural cycle and dynamics of population.

**Bayero University, Kano (BUK)**

**Life Sciences**

**Plant Biology**

**B.Sc. Botany**

**BUK-BOT 201: Introduction to Horticulture (2 Units Core: LH 30)**

**Senate approved relevance**

Horticulture crops play a significant role in Nigerian economy by providing food, raw materials to various food processing industries, economic gain to farmers and generating employment. Conducive agro-climatic conditions in Nigeria ensure the production of diverse horticultural crops. The production of horticultural crops is far below the existing demand in the country. Scale up production requires knowledge and training in horticulture and this is in line with BUK’s mission of producing skilled man power that will facilitate rapid development of Agricultural sector in the country. The significance of this course is seen in Biotechnology graduate from BUK, providing skills and innovations needed for the transformation of horticulture industry in arid and semi-arid regions of Nigeria.

**Overview**

The course is designed to introduce the students to basic concepts and skills utilized in horticulture. Students will be introduce to basic botanical concepts, morphology, anatomy, taxonomy, physiology, genetics and propagation as they apply to horticulture as well as the role of different classes of plant hormones in plant propagation.

The course will also introduce students to different classes of horticultural crops; Oleiriculture, floriculture, pomology, industrial and plantation crops, principle and practice of horticulture. Towards the end of the course, students will be train on field establishment of horticultural crops, management and cultural practices; climatic and soil requirements, transplanting methods, weed management practices, harvesting, handling and storage.

**Objectives**

The objectives of the course are to:

1. Teach students the concepts and skills utilized in horticulture.
2. Train students on the basic morphological structure, anatomy and physiology of horticultural crops.
3. Educate students on the hormonal regulation of growth and development in plants.
4. Tutor the students on various classes of horticultural crops and their methods of cultivation.
5. Educate students on the climatic conditions, soil and nutrients requirements for successful plant propagation
6. Train students on the field establishment of horticultural crops.
7. Educate students on the management and cultural practices required in the cultivation of horticultural crops.

**Learning outcomes**

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

1. Enumerate at least 4 plant hormones
2. Demonstrate adequate understanding basic concepts and skills employed in horticulture
3. Demonstrate clear understanding of the morphology, anatomy and physiology of plants
4. Outline the roles of plant hormones in the propagation of horticultural crops
5. Demonstrate considerable skill on the propagation of at least 3 classes of horticultural crops
6. Describe the climatic, soil nutrients conditions needed for optimum growth and development in plants
7. Demonstrate ability to establish and manage different horticultural crops

**Course contents**

Basic concepts and skills utilized in horticulture, description basic botanical concepts; morphology, anatomy, taxonomy, physiology, genetics and propagation as they relate to horticulture, plant growth regulators, classes of horticultural crops; Oleiriculture, floriculture, pomology, industrial and plantation crops, principle and practice of horticulture. Field establishment of horticultural crops, management and cultural practices; climatic and soil requirements, transplanting methods, weed management practices, harvesting, handling and storage

**Bayero University, Kano (BUK)**

**Life Sciences**

**Plant Biology**

**B.Sc. Botany**

**BUK-BOT 208: Practical Horticulture (1 Unit Core: PH 45)**

**Senate approved relevance**

Training of high–quality graduates who are highly skilled in the establishment of home, public and commercial gardens, landscaping services, orchard production and maintenance of soil conservation techniques in the northern part of Nigeria and Nigeria at large. Relevance is seen in Kano Botanic gardens where most of botany graduates are part of the commercial gardeners for being able to develop soil and garden techniques to mitigate soil erosion as a result of climate change as well as increase of garden production through afforestation programme.

**Overview**

Garden, orchard and landscaping techniques are important elements used in mitigating climate change as a result of air pollution, erosion and food shortages especially fruits and vegetables particularly in the arid and semi-arid areas of Nigeria. Where afforestation is emphasized, these elements focused on preparing students in practical horticulture with the knowledge and skills on how to conserve the soil, garden, and orchard.

This practical course is designed to expose students to various soils, gardens landscaping and orchard techniques for conserving soils and improving the climatic conditions of the environment by controlling the temperature level, and other climate attributes and to educate them on how to revive climate change and to arrest global warming. Also to build the capacity of students in addressing deforestation in the arid and semi-arid areas of Nigeria. The importance of the course is based on the need of achieving sustainable development goals in the areas of poverty reduction, zero hunger, sustainable communities/cities and climate action issues respectively. The objectives of the course, learning outcome, and course contents are provided to address this need.

**Objectives**

The objectives of the course are to:

1. Expose students to principles of soil quality and control of soil erosion
2. Train students on practical exercises about budding of citrus, grafting of mango and guava air layering.
3. Train students on how to practically establish pre-nursery operations and nursery beds.
4. Train students on the botanical identification, techniques of gardening, orchard and landscaping plants.
5. Guide students on the operational principles and maintenance of garden, orchard and landscaping techniques.
6. Train students on how to identify insect’s pest and disease as well as their control measures.
7. Teach students different types of garden and landscaping in Kano environment.

**Learning outcomes**

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

1. Describe at least four (4) principles and control of soil quality and control of soil erosion.
2. Conduct practical exercises on the three widely used propagation methods: budding, grafting and air layering in at least 2 varieties of citrus, mango and guava respectively.
3. Establish nursery and nursery beds, following basic operations.
4. Describe the procedures used in the establishment of garden, orchard and landscape.
5. Describe at least seven (7) operational principles and maintenance of garden, orchard and 2 landscaping techniques
6. Identify at least five (5) pests and diseases with their control measures.
7. Describe at least four (4) different types of gardens and landscape in Kano environment.

**Course contents**

The principles of soil quality and control of soil erosion; Practical exercises on budding citrus, grafting mango and guava air layering; Practical exercises on pre-nursery and nursery beds; cultivation of some vegetables e,g tomato, garden egg, melons, cabbage and leaf vegetable; Identification techniques of garden, orchard and landscaping plants; Operational principles and maintenance of garden, orchard and landscape; Insects’ pests and disease with their control measures; Different types of garden and landscaping techniques.

**Bayero University, Kano (BUK)**

**Life Sciences**

**Plant Biology**

**B.Sc. Botany**

**BUK - BOT 206 – Introduction to Experimentation in Botany (2 Units Core: LH 30)**

**Senate approved relevance**

The development and application of statistical methods for gathering, arranging, summarizing, presenting and evaluating sample data, as well as drawing accurate conclusions on population characteristics and making rational decisions based on the analysis output to a wide range of topics in botany is matching with the institutional mission of producing high quality human and agricultural resources required for addressing African Developmental challenges through cutting-edge research, knowledge transfer and training of high-quality graduates.

**Overview**

The introduction of Experimentation in Botany will give fresh students background skill and awareness on design of experiment, collection and analysis of data from experiments in plant biology.

The course is also designed to prepare students on various mathematical interpretations of data as an important part in the sustainable development in the growth and development of plant biology, including agriculture especially in assessing, arranging and determining the agricultural activity of developing countries. Because agricultural investigations are based on the application of statistical methods and procedures which are helpful in testing hypotheses using observed data, in making estimations of parameters and in predictions.

**Objectives**

The objectives of the course are to:

1. Train students to rationalize experimentation and its application in the design, collection and summarization of data.
2. Prepare students on the application and conditions of usage of different experimental designs.
3. Teach students definition and significance of data, variables and their types in botany experiments.
4. Equip students with illustration of sampling procedures in Botany.
5. Train students how to summarize and present botanical data.
6. Train students on how to describe data using measures of central tendency and dispersion as well as probability theory.

**Learning outcomes**

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

1. Explain experimentation and list at least ten (10) application of experimentation in Botany.
2. Familiarize at least five experimental designs and conditions of their applications.
3. Differentiate between continuous and discontinuous data and variables.
4. Explain four sampling procedures in Botany.
5. Explain at least two ways on how to summarize and present botanical data.
6. Describe data using measures of central tendency and dispersion as well as probability theory.

**Course contents**

Experimentation and its application in Botany; Principles of experimental design; Statistical sampling procedures; Variability in botanical data: Continuous and discontinuous data and variables; Data collection, organization and presentation; Descriptive Statistics – (i) Measures of central tendency: mean, median and mode of ungrouped and grouped data (ii) Measures of dispersion: variance, range, standard deviation, kurtosis and skewness; Probability **-** Elementary probability, Distributions such as Bernoulli, binomial, normal and poison.

**Bayero University, Kano (BUK)**

**Life Sciences**

**Plant Biology**

**B.Sc. Botany**

**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 Botany 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 Botany 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**

The objectives of the course are to:

1. Guide students to understand biorisk, biohazard and biosafety
2. Train students on the identification of biorisk, bioharzard and biosafety in laboratory, environment and health sciences.
3. Equip students with procedures on how to assess biorisk, bioharzard and biosafety in the laboratory and environment.
4. Teach students how to describe biorisk management framework
5. Equip students with understanding of techniques used in biological waste management
6. Educate students on the relevance of biorisk management in global health security framework
7. Guide students on biosecurity and biocontainment measures.

**Learning outcomes**

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

1. Explain the three keywords in biorisk management: biorisk, biohazard and biosafety
2. At least identify two ways each for biorisk, biohazard and biosafety in laboratory, environment and health
3. Distinguish biorisk, biohazard and biosafety in laboratory and environment
4. Describe the biorisk management framework in different ways
5. Familiarize at least two techniques used in biological waste management
6. Explain at least five relevance of biorisk management in global health security framework
7. Describe three measures of biosecurity and biocontainment using 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. Botany**

**BUK-BOT 308: Post-harvest Physiology of Fruits (2 Units Core: LH 15; PH 45)**

**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, the University is committed in addressing food security in the area. This course is designed with the aim of producing graduates in Botany who are knowledgeable in post-harvest physiology of fruits with a view to addressing the fruits losses due to storage in the arid and semi-arid areas of Nigeria.

**Overview**

The course, Post-harvest Physiology of fruits, is designed to educate students of Botany with knowledge of post-harvest physiological process of fruits and the ripening mechanism. The course is also expected to inculcate the knowledge of the physiology of fruits leading to ripening stages in arid and semi-arid regions of Nigeria.

The course is also designed to introduce students to different factors in the environment that affects the ripening of fruits in the area. The course will also educate students on different methods of prolonging shelf-life of fruits in the area, specifically the perishable fruits such as tomatoes, pepper, onion, etc.

**Objectives**

The objectives of the course are to:

1. Train students acquire knowledge in the classification of fruits and different types of fruits.
2. Educate students on physiological changes of fruits after harvest such as degradation of chlorophylls, ethylene production and biochemical changes.
3. Equip students with skill to identify types and differences between climacteric and non-climacteric fruits.
4. Educate students on the various methods of prolonging the shelf-life of fruits under storage.
5. Train students on post-harvest deterioration of fruits and treatments (field and store).
6. Guide students on the general techniques of reducing post-harvest losses from harvest to storage in arid and semi-arid areas of Nigeria.

**Learning outcomes**

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

1. Discuss the classification and identification of different types of fruits commonly stored in the arid and semi-arid areas.
2. Explain at least three physiological mechanisms of fruit ripening in climacteric and non-climacteric fruits.
3. Discus the biochemical changes in fruits after harvest and the application of at least three hormones/chemicals in extending the shelf-life of fruits.
4. Describe at least four methods of prolonging the shelf-life of fruits under storage.
5. Explain at least four symptoms of fruits deterioration as it affects shelf life of fruits during storage.
6. Describe at least four of the general principles of how fruit losses before and after harvest can be reduced.

**Course contents**

Classification of fruits, and types of fruits commonly stored in the area; Post-harvest physiology of stored fruit: ethylene, chlorophyll degradation and biochemical changes; Climacteric and non- climacteric fruits; Field treatment of fruits in relation to their post-harvest physiological deterioration; Methods of prolonging shelf-life of fruits: refrigeration, drying, vacuum and liquid nitrogen storage, local method of fruits storage; general principles of reducing post-harvest losses: harvesting, handling before packaging, sorting and cleaning, packaging, transportation, storage, sanitation.

**Bayero University, Kano (BUK)**

**Life Sciences**

**Plant Biology**

**B.Sc. Botany**

**BUK - BOT 307 – Phycology (3 Units Core: LH 30, PH 45)**

**Senate approved relevance**

Exploring aquatic plants treasures that are basically under-valued but plays important roles in agriculture and other socioeconomics is compatible with the institutional mission of producing high quality human and agricultural resources required for addressing African Developmental challenges through cutting-edge research, knowledge transfer and training of high-quality graduates.

**Overview**

Studying aquatic plants will develop in students, the understanding of the structure, function, dynamics and classification of plant-dominated aquatic communities and ecosystems.

The course is also designed to expose students to various undervalued treasures of aquatic plants and consequences of excessive growth of alien plant species towards constraining agricultural and other socioeconomic activities.

**Objectives**

The objectives of the course are to:

1. Equip students with ability to identify major classes of algae with their examples
2. Teach students the structure of some algae growing in municipal ponds
3. Expose students to the life histories of representative members of major algal classes
4. Equip students with knowledge of the reproductive strategies of phytoplanktons.
5. Train students who can conduct analysis on the physicochemical properties of the aquatic habitat and their effect on the growth and invasion of aquatic plants.
6. Inculcate students to understand the aquatic plant treasures
7. Teach students biological adaptations of algae for survival in aquatic habitats
8. Equip students with knowledge of the types, primary causes and consequences of eutrophication in municipal ponds after conducting field survey.

**Learning outcomes**

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

1. Recognize the six major classes of algae using taxonomic keys.
2. Describe at least five structural forms exhibited by algae to establish in aquatic habitats.
3. Illustrate the life histories of at least two representative members of major algal classes.
4. State ten (10) biological adaptations each of algal classes for survival in aquatic habitats
5. Highlight the relationships between at least ten (10) physicochemical parameters of the aquatic habitat and algal growth and invasion.
6. State at least ten aquatic plant treasures
7. Explain the types, three primary causes and consequences of eutrophication in municipal ponds after conducting a field survey.

**Course contents**

Classification of algae; Physicochemical properties of water and their biological significance; Structure, function, reproduction and life histories of representative members of bacillariophyta, chlorophyta, cyanophyta, euglenophyta, pyrrophyta and Rhodophyta; Aquatic plants treasures; Eutrophication, its causes and consequences; Survey of algae in municipal pond waters.

**Bayero University, Kano (BUK)**

**Life Sciences**

**Plant Biology**

**B.Sc. Botany**

**BOT 306: Plant Breeding (3 Units C: LH 15; PH 90)**

**Senate approved relevance**

Plant breeding is an important tool in promoting global food security, and many staple crops have been bred to better withstand extreme weather conditions associated with global warming, such as drought or heat waves. The course is compatible with the institutional mission of producing high quality human and agricultural resources required for addressing African Developmental challenges through cutting-edge research, knowledge transfer and training of high-quality graduates.

**Overview**

Studying the most frequently employed plant breeding technique (hybridization) is to bring together desired traits found in different plant lines into one plant line via cross- pollination.

The course is also designed to expose students on the procedures on improving the quality of the seeds which would in turn positively affect people all over the world.

**Objectives**

The objectives of the course are to:

1. Expose students to the objectives of plant breeding;
2. Educate students on the origin and domestication of plant breeding methods;
3. Train students on chromosomes manipulation;
4. Expose students to breeding methods; and
5. Introduce students to recurrent selection.

**Learning Outcomes**

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

1. Identify the objectives of plant breeding;
2. Explain the origin and domestication of plant breeding methods;
3. Describe the chromosomes manipulation;
4. Discuss breeding method; and
5. Appraise recurrent selection.

**Course Contents**

The objectives of plant breeding; origin and domestication of plant breeding. Self-pollinated and cross-pollinated crops. Breeding methods, pure line breeding and mass selection; pedigree method; bulk population breeding; back cross breeding. Recurrent selection, chromosome manipulation.

**Bayero University, Kano (BUK)**

**Life Sciences**

**Plant Biology**

**B.Sc. Botany**

**BUK-BOT 420 – Research Methodology (3 Units Core: LH 45)**

**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. This course is designed with the aim of producing graduates in Botany who are knowledgeable in basic components of research and data analysis. The University has provided enabling environment for research through provision of equipped laboratories and other facilities.

**Overview**

The course, Research Methodology and data analysis is designed to educate students of Botany with knowledge of research methods and statistical analysis.

The course is also designed to expose students to the use of MS- Excel in data entry and statistical analysis and also to build the capacity of students in appropriate experimental design, survey study, data collection and reporting of scientific findings. The course highlights the importance of searching for relevant and related literatures with appropriate citations. It will also introduce students to basic principles of ethics in scientific research and how to avoid plagiarism.

**Objectives**

The objectives of the course are to:

1. Educate students on knowledge of research in Botany ahead of preparation for final year project.
2. Equip students with knowledge of types of survey and sampling procedures.
3. Train students on the different types of experimental design and their application to research in Botany.
4. Teach students basic methods of data collection and management for appropriate statistical analysis.
5. Train students on different search techniques and review of literature.
6. Guide students on ethical considerations in research involving plants and how to avoid plagiarism.

**Learning outcomes**

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

1. Differentiate between experimental and survey study.
2. Discuss at least four principles of experimentation, experimental designs.
3. Discuss the types of survey study, sampling design and define at least three terms used in statistics: samples, unit and populations.
4. Describe the types of data, management and at least five common errors encountered in data entry
5. Describe the processes of hypothesis testing in parametric and non-parametric data.
6. Apply the procedures of data entry and construct line graph, histogram, charts and other analyses using MS-Excel.
7. Discuss ethical considerations in research involving animal subjects, e.t.c.
8. Discuss the structure of projects chapters and other scientific reporting.

**Course contents**

Experimental and survey study: principles of experimentation, experimental design, sampling design, population and samples, data collection and management, common errors in data collection, data input in Excel. Data analysis: hypothesis testing, common errors in hypothesis testing, statistical analysis in parametric (student’s T test, analysis of variance, correlation and Regression) and non-parametric (Chi-square test, sign test) data. Computer application in data analysis- MS-Excel. Research ethics: significance of research ethic, code and policies of research ethics. Writing project and scientific reports: choosing topics for literature search, compilation of citations, writing literature reports, how to avoid plagiarism.

**Bayero University, Kano (BUK)**

**Life Sciences**

**Plant Biology**

**B.Sc. Botany**

**BOT 402: Economic Botany (2 Units C: 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. This course is designed with the aim of producing graduates in Botany who are knowledgeable in the study of economically important plants and their products.

**Overview**

The course, Research Methodology and data analysis is designed to educate students of Botany study the relationship between people (individuals and cultures) and plants. Economic botany intersects many fields including established disciplines such as agronomy, anthropology, archaeology, chemistry, economics, ethnobotany, e.t.c.

The course is also designed to expose students to the processes as well as the products involved in plant cultivation in the past and present.

**Objectives**

The objectives of the course are to:

1. Introduce students to some Nigerian plants with economic value;
2. Guide students recognize plants that produce oils, rubber, fibres, dyes;
3. Prepare students to understand botany of the identified economic plants; and
4. Train students in the evaluation of the products of the economic plants.

**Learning Outcomes**

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

1. Assess some Nigerian plants with economic value;
2. Recognize plants that produce oils, rubber, fibres, dyes;
3. Describe the botany of the identified economic plants; and
4. Evaluate the products of the economic plants.

**Course Contents**

A study of the botany, cultivation, processing and uses of tropical plants with particular references to Nigerian economic plants will be undertaken. Plants producing oils, rubber and wood products, fibres, dyes and leather tanning materials, sugar and pharmaceutical products.

**Bayero University, Kano (BUK)**

**Life Sciences**

**Plant Biology**

**B.Sc. Botany**

**BOT 408: Plant Tissue Culture (3 Units C: LH 15; PH 90)**

**Senate approved relevance**

The course “Plant Tissue Culture” is compatible with the vision and mission of Bayero University 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.

**Overview**

Tissue Culture is becoming as an alternative means to vegetative propagation

of plants. In vitro growing plants are usually free from bacterial and fungal

diseases. Virus eradication and maintenance of plants in virus free stage can

also be rapidly achieved in cultures.

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diseases. Virus eradication and maintenance of plants in virus free stage can

also be rapidly achieved in cultures.

Tissue culture involves the use of small pieces of plant tissue (explants) which are cultured in a nutrient medium under sterile conditions. The course is designed to educate students of Botany study the protocols of plant tissue culture.

The course is also designed to expose students to the processes as well as the products involved in plant tissue culture.

**Objectives**

The objectives of the course are to:

1. Educate students on different tissue used in culture;
2. Introduce students to the roles of hormones and vitamins in culture;
3. Guide students on the evaluation of various techniques in the tissue culture; and
4. Train students on how application of tissue culture could be integrated in plant breeding

**Learning Outcomes**

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

1. Demonstrate different tissue used in culture;
2. Identify the roles of hormones and vitamins in culture;
3. Evaluate various techniques in the tissue culture; and
4. Appraise the application of tissue culture in plant breeding.

**Course Contents**

Meristem culture, organ cultivation, embryo culture. The role of plant hormones and vitamins. Techniques of plant tissue culture. Applications of plant tissue culture in plant breeding.

**Bayero University, Kano (BUK)**

**Life Sciences**

**Plant Biology**

**B.Sc. Botany**

**BOT 414: Plant Molecular Biology (3 Units C: LH 45)**

**Senate approved relevance**

Training of high quality graduates who are highly skilled and knowledgeable in molecular biology 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**

Molecular biology is the study of the composition, structure and interactions of cellular molecules – such as nucleic acids and proteins – that carry out the biological processes essential for the cell's functions and maintenance. 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 designed to enable students learn manipulations on how staple crops will be 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. Train students on how to appraise fundamentals of plant molecular biology;
2. Educate students on structure of nuclear genes;
3. Teach students plant organelles and microbe interactions;
4. Demonstrate to students DNA and RNA structure;
5. Expose students to golgi and mitochondria structure; and
6. Train students on plant biotechnology.

**Learning Outcomes**

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

1. Appraise fundamentals of plant molecular biology;
2. Recognize the structure of nuclear genes;
3. Explain the plant organelles and microbe interactions;
4. Describe DNA and RNA structure;
5. Distinguish golgi and mitochondria structure; and
6. Demonstrate plant biotechnology.

**Course Contents**

Fundamental and applied aspects of plant molecular biology, structure, expression and isolation of plant nuclear genes. Biogenesis of microtubule, microfilaments. Golgi apparatus and mitochondria. Membrane and membrane interactions. Cell wall structure and properties of DNA and RNA. Molecular biology of plant development, plant organelles and plant-microbe interactions and plant biotechnology.

**Bayero University, Kano (BUK)**

**Life Sciences**

**Plant Biology**

**B.Sc. Botany**

**BOT 417: Plants and Environmental Pollution Monitoring (3 Units C: LH 30; PH 45)**

**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. This course is designed with the aim of producing graduates in Botany who are knowledgeable in phytoremediation.

**Overview**

The course is designed to educate students of Botany with knowledge of phytoremediation. The course is also expected to inculcate the knowledge of the pollution cleanup using plant species in arid and semi-arid regions of Nigeria.

The course is also designed to introduce students to different plant species used in the establishment of safe environment. The course will also educate students on different methods pollution remediation using phytos.

**Objectives**

The objectives of the course are to:

1. Train students of how seedless plants can be identified in the monitoring of environmental pollution
2. Expose students to higher plants that can be used to monitor environmental pollution;
3. Educate students on role of algae that in serving as indicators of aquatic pollution; and
4. Train students on diagnosing merits and demerits of using various taxonomic groups as indicators.

**Learning Outcomes**

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

1. Identify seedless plants that can be used to monitor environmental pollution;
2. Identify higher plants that can be used to monitor environmental pollution;
3. Extrapolate the algae that can serve as indicators of aquatic pollution; and
4. Diagnose merits and demerits of using various taxonomic groups as indicators.

**Course Contents**

The use of algae, lichens, bryophytes and higher plants in monitoring environmental pollution. The use of algae as indicators of aquatic pollution. The merits and demerits of using various taxonomic groups as indicators.