**BAYERO UNIVERSITY, KANO**

**FACULTY OF PHYSICAL SCIENCES**

**DEPARTMENT PHYSICS**

**Proposed B.Sc. Physics 30% Additional course to the CCMAS**

**Table 1: Tabulated Level One (1) course for B.Sc. Physics Students**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Course Code** | **Course Title** | **Unit(s)** | **Status** | **LH** | **PH** |
| BUK-MTH- 103 | Elementary Mathematics III | 2 | C | 30 | - |
| BUK-STA-112 | Introduction to Statistics and Probability | 3 | C | 45 | - |
|  | **Sub-total** | **5** |  |  |  |
| BUK-CHM 101 | General Chemistry I | 2 | C | 30 | - |
| BUK-CHM- 102 | General Chemistry II | 2 | C | 30 | - |
| BUK-CHM 107 | General Chemistry Practical I | 1 | C | - | 45 |
| BUK-CHM-108 | General Chemistry Practical II | 1 | C | - | 45 |
|  | **Sub-total** | **6** |  |  |  |
| BUK-BIO-101 | General Biology I | 2 | C | 30 |  |
| BUK-BIO-102 | General Biology II | 2 | C | 30 |  |
| BUK-BIO-107 | General Biology Practical I | 1 | C |  | 45 |
| BUK-BIO-108 | General Biology Practical II | 1 | C |  | 45 |
|  | **Sub-total** | **6** |  |  |  |
|  | **Total** | **17** |  |  |  |

**A candidate is expected to register the first five (5) credits and any of either chemistry or biology, making a total of eleven (11) credits.**

**Table 2:Tabulated Level Two (2) course for B.Sc. Physics Students**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| S/N | **Course Code** | **Course Title** | **Units** | **Status** | **LH** | **PH** |
| 1 | BUK-COS- 201 | Computer Programming I | 3 | C | 30 | 45 |
| 2 | BUK-MTH- 201 | Mathematical Methods I | 2 | C | 30 | - |
| 3 | BUK-MTH- 202 | Elementary Differential Equations | 2 | C | 30 | - |
| 4 | BUK-PHY-201 | Introduction to space science | 2 | C | 30 |  |
| 5 | BUK-PHY-202 | Introduction to Data Science | 3 | C | 30 |  |
|  |  | **Total** | **12** |  |  |  |

**Table 3:Tabulated Level Three (3) course for B.Sc. Physics Students**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| S/N | **Course Code** | **Course Title** | **Units** | **Status** | **LH** | **PH** |
| 1 | BUK-PHY-301 | Artisan Physics | 2 | C | 30 |  |
| 2 | BUK-PHY-302 | Vector and Tensor Analysis | 2 | C | 30 |  |
| 3 | BUK-MTH-304 | Complex Analysis | 2 | C | 30 |  |
|  |  | **Sub-total** | **6** |  |  |  |
| 4 | BUK-PHY-303 | Biophysics | 2 | E | 30 |  |
| 5 | BUK-PHY-304 | Introduction to Acoustics | 2 | E | 30 |  |
| 6 | BUK-PHY-305 | Introduction to Geophysics | 2 | E | 30 |  |
| 7 | BUK-PHY-306 | Electronic Circuits | 2 | E | 30 |  |
| 8 | BUK-PHY-307 | Atmospheric Physics & Weather | 2 | E | 30 |  |
| 9 | BUK-PHY 316 | Circuit Theory | 2 | E | 30 |  |
|  |  | **Sub-total** | **12** | E |  |  |
|  |  | **Total** | **18** |  |  |  |

**Table 4:Tabulated Level Four (4) course for B.Sc. Physics Students**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **S/N** | **Course Code** | **Course Title** | **Units** | **Status** | **LH** | **PH** |
| 1 | BUK-PHY-401 | Quantum Computing | 3 | C | 45 |  |
| 2 | BUK-PHY-404 | National Energy Policy | 1 | C | 15 |  |
|  |  | **Sub total** | **4** |  |  |  |
| 3 | BUK-PHY-402 | Plasma Physics | 2 | E | 30 |  |
| 4 | BUK-PHY-403 | Physics of the Earth | 2 | E | 30 |  |
| 5 | BUK-PHY-405 | Introduction to Astrophysics and Cosmology | 2 | E | 30 |  |
| 6 | BUK-PHY-406 | Modern Optics | 2 | E | 30 |  |
| 7 | BUK-PHY-407 | Advance Analytical Mechanics | 2 | E | 30 |  |
| 8 | BUK-PHY-408 | Atomic and Molecular Spectroscopy | 2 | E | 30 |  |
| 9 | BUK-PHY-409 | Dynamic Meteorology | 2 | E | 30 |  |
| 10 | BUK-PHY-411 | Nuclear and Particle Physics | 3 | E | 45 |  |
| 11 | BUK-PHY-412 | Acoustics | 2 | E | 30 |  |
| 12 | BUK-PHY-413 | Electromagnetism and Relativity | 2 | E | 30 |  |
| 13 | BUK-PHY-414 | Solid State Physics | 2 | E | 30 |  |
| 14 | BUK-PHY-415 | Surfaces and Interfaces | 2 | E | 30 |  |
| 15 | BUK-PHY-416 | Astrophysics | 2 | E | 30 |  |
| 16 | BUK-PHY-417 | Gases | 2 | E | 30 |  |
| 17 | BUK-PHY-418 | Liquids | 2 | E | 30 |  |
| 18 | BUK-PHY-419 | Solids | 2 | E | 30 |  |
| 19 | BUK-PHY-420 | Semiconductor Devices | 2 | E | 30 |  |
| 20 | BUK-PHY-421 | Forensic Physics | 2 | E | 30 |  |
| 21 | BUK-PHY-422 | Introduction to Photonics | 3 | E | 45 | 45 |
| 22 | BUK-PHY-422 | Digital Electronics | 2 | E | 30 |  |
|  |  | **Sub-total** | **42** |  |  |  |
|  |  | **Total** | **46** |  |  |  |

**1.1 BUK-STA 112: Probability I (3 Units C: LH 45)**

**Senate- approved relevance**

Bayero University Kano’s vision is*to lead in research and education in Africa*. Hence the need to produce graduates that are equipped with knowledge of Physics in everyday life who are expected to develop capacity of questioning and rational thinking that will provide answers to societal challenges through the conduct of pivotal researches for the improvement and protection of life. Probability is a statistical course that will widen the horizon of the graduates on the modern space exploration, theoretical basis of physical laws and pragmatic analysis of data.

**Overview**

The module provides an overview of the Probability phenomena, that lead to the better comprehension of basic Physics in our daily experience. We look at the Permutation and combination method in explaining Physics laws and theories, and theConcepts and principles of probability aid the explanations in the behavior of matter, dry and moist air (cloudsand rain), among others. Random variables. Probability and distribution functions, can be exploit in many areas of Physics for instance prediction on how the atmosphere is observed and measured, Satellite Communications, andhow those measurements are combined with the laws of physics to provide aweather forecast.

**Learning Objectives**

1. Define Probabilities Distribution
2. Describe Random Variable
3. Recognize probability distribution function
4. List areas Physics can apply statistical variables
5. Demonstrate and explain how Probability can be employed in weather forecast

**Learning Outcomes**

At the end of the course students should be able to

1. explain the differences between permutation and combination;
2. explain the concept of random variables and relate it to probability and distribution functions;
3. describe the basic distribution functions; and
4. Explain the concept of exploratory data analysis.
5. List area(s) probability can aid in Physics laws and principles

**Course Contents**

Permutation and combination. Concepts and principles of probability. Random variables. Probability and distribution functions. Basic distributions: Binomial, geometric, Poisson, normal and sampling distributions; exploratory data analysis.

**Minimum Academic Standards**

Physics Labs and Classes along with the NUC-MAS requirement facilities.

**1.2 BUK-MTH 103: Elementary Mathematics III (Vectors, Geometry and Dynamics) (2 Units C: LH 30)**

**Senate- approved relevance**

Bayero University Kano’s vision is *to lead in research and education in Africa*. Hence the need to produce graduates that are equipped with knowledge of Physics in everyday life who are expected to develop capacity of questioning and rational thinking that will provide answers to societal challenges through the conduct of pivotal researches for the improvement and protection of life. Probability is anElementary Mathematicsis a very important course that will widen the horizon of the graduates on the Mechanic, Fluid Dynamics, Behavior of Matter,theoretical basis of physical laws and pragmatic analysis in medical Physics.

**Overview**

The module provides an overview of the basic MathematicalPrinciple, Theorem and laws that lead to the better comprehension of general Physics in our daily experience. Geometric representation of vectorsin 1D, 2D and 3D will help in compression of a lot of physics course in the future. This will also make the graduate to fully key into the real life problem by solving theoretical situations in this dimension. In addition, scalar, multiplication of vectors, linear independence are key mathematical tools in comprehending Physics laws/Theory. Scalar and vector products of two vectors will largely help in explaining Physics principles, and concepts. Kinematics of a particle, Force, momentum, laws of motion under gravity, projectiles and resisted vertical motion are topics that helps graduated to be a Good Physicist. These and other Basics mathematical topics all combined with the laws of physics will shape the graduate in critical thinking and objective analyses.

**Learning Objectives**

1. List the principles/laws/theorems and evaluate them in the simplest applicable method(s)
2. Demonstrate understanding of basics mathematical principles to be employed in Physics
3. Categorize physics problems in various sectors
4. Analyze the problem in different areas of in life
5. Combine these basic knowledge in arriving at a solution to a problem

**Learning Outcomes**

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

1. solve some vectors in addition and multiplication;
2. calculate force and momentum; and
3. solve differentiation and integration of vectors.
4. To identify mathematically 1D, 2D, and 3D.
5. To solve simple dynamic problems in force and momentum

**Course Contents**

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

**Minimum Academic Standards**

ChemistryClasses along with the NUC-MAS requirement facilities.

**1.3 BUK-CHM 101: General Chemistry I (2 Units C: LH 30)**

**Senate- approved relevance**

Bayero University Kano’s vision is *to lead in research and education in Africa*. Hence the need to produce graduates that are equipped with knowledge of Physics in everyday life who are expected to develop capacity of questioning and rational thinking that will provide answers to societal challenges through the conduct of pivotal researches for the improvement and protection of life. General Chemistry is one of the pivotal course that shape Physics Graduates. This course is used to set the foundation of Nuclear Physicist, Radiation Physics, and many other areas of Physics.

**Overview**

The module provides an overview of the rudimentaryChemistry Known, that aa scientist will need in the future. This course help in setting the ball rolling starting from the very basics of Atoms to how the react with matter. Atoms, molecules, elements and compounds and chemical reactions will be discussed exhaustively. Principles in elementary chemistry like Elementary thermochemistry. rates of reaction, equilibrium and thermodynamics, wil aid the graduates in myriads ways.Topics like Acids, bases and salts. Properties of gases. Redox reactions and introduction to electrochemistry. Radioactivity, will pave way for courses in Physics like Thermal Physics, Modern Physics, Electronics circuits, Analytical mechanics, Geophysics and many more. These and other Basics scientific topics all combined with the laws of physics will shape the graduate in critical thinking and objective analyses.

**Learning Objectives**

1. List the principles/laws/theorems and evaluate them in the simplest applicable method(s)
2. Demonstrate understanding of basics mathematical principles to be employed in Physics
3. Categorize physics problems in various sectors
4. Analyze the problem in different areas of in life
5. Combine these basic knowledge in arriving at a solution to a problem

**LearningOutcomes**

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

After studying all materials and resources presented in the course, the student will be able to:

1. define atom, molecules and chemical reactions;
2. discuss the Modern electronic theory of atoms;
3. write electronic configurations of elements on the periodic table;
4. justify the trends of atomic radii, ionization energies, electronegativity of the elements based on their position in the periodic table;
5. identify and balance oxidation – reduction equation and solve redox titration problems;
6. illustrate shapes of simple molecules and hybridized orbitals;
7. identify the characteristics of acids, bases and salts, and solve problems based on their quantitative relationship;
8. apply the principles of equilibrium to aqueous systems using LeChatelier’s principle to predict the effect of concentration, pressure and temperature changes on equilibrium mixtures;
9. Analyze and perform calculations with the thermodynamic functions, enthalpy, entropy and free energy; and
10. determine rates of reactions and its dependence on concentration, time and temperature.

**Course Contents**

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

**Minimum Academic Standards**

Chemistry Labs and Classes along with the NUC-MAS requirement facilities.

**1.4 BUK-CHM 102: General Chemistry II (2 Units C: LH 30)**

**Senate- approved relevance**

Bayero University Kano’s vision is *to lead in research and education in Africa*. Hence the need to produce graduates that are equipped with knowledge of Physics and chemistry in sciences is very important in our everyday life who. Graduate are expected to develop capacity of questioning and rational thinking that will provide answers to societal challenges through the conduct of impactive researches for the improvement and protection of life and its environment. General Chemistry II is a continue of BUK –CHM 101. This course is also used to prepare the foundation of Nuclear Physicist, Radiation Physics, and many other areas of Physics.

**Overview**

The module provides an overview of the rudimentary Chemistry Known, that aa scientist will need in the future. This course help in setting the ball rolling starting from the very basics of Atoms to how the react with matter. Atoms, molecules, elements and compounds and chemical reactions will be discussed exhaustively. Principles in elementary chemistry like Elementary thermochemistry. rates of reaction, equilibrium and thermodynamics, will aid the graduates in myriads ways.Topics likeOrganic Synthesis, Isolation and purification of Organic compounds, and Nomenclature and functional group classes of organic compounds.

**Learning Objectives**

1. Enumerate the Fullerenes as fourth allotrope of carbon
2. Establish the basics ofIsolation and purification of organic compounds
3. Classify Nomenclature and functional group classes of organic compounds
4. Investigate the problem in different areas of in life in relation to Physics
5. Chain these basic knowledge in arriving at a solution to a problem

**Learning Outcomes**

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

1. state the importance and development of organic chemistry;
2. define fullerenes and their applications;
3. discuss electronic theory;
4. determine the qualitative and quantitative of structures in organic chemistry;
5. describe rules guiding nomenclature and functional group classes of organic chemistry;
6. determine rate of reaction to predict mechanisms of reaction;
7. identify classes of organic functional group with brief description of their chemistry;
8. discuss comparative chemistry of group 1A, IIA and IVA elements; and
9. describe basic properties of Transition metals.

**Course Contents**

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

**Minimum Academic Standards**

PhysicsClasses along with the NUC-MAS requirement facilities.

**1.5 BUK-CHM 107: General Chemistry Practical I (1 Unit C: PH 45)**

**Senate- approved relevance**

Bayero University Kano’s vision is *to lead in research and education in Africa*. Hence the need to produce graduates that are equipped with knowledge of Physics in everyday life who are expected to develop capacity of questioning and rational thinking that will provide answers to societal challenges through the conduct of pivotal researches for the improvement and protection of life. General Chemistry is one of the pivotal course that shape Physics Graduates. This course is used to set the foundation of Nuclear Physicist, Radiation Physics, and many other areas of Physics.

**Overview**

The module provides an overview of the rudimentary Practical Chemistry Knowledge, that a scientist will need in the future. This course help in setting the ball rolling starting from the very basics of Atoms to how the react with matter. Atoms, molecules, elements and compounds and chemical reactions will be discussed exhaustively. Principles in elementary chemistry like Elementary thermochemistry. rates of reaction, equilibrium and thermodynamics, will aid the graduates in myriads ways.Topics like Acids, bases and salts. Properties of gases. Redox reactions and introduction to electrochemistry. Radioactivity, will pave way for courses in Physics like Thermal Physics, Modern Physics, Electronics circuits, Analytical mechanics, Geophysics and many more. These and other Basics scientific topics all combined with the laws of physics will shape the graduate in critical thinking and objective analyses.

**Learning Objectives**

1. Enlighten the principles/laws/theorems and evaluate them in the simplest applicable method(s)
2. Establishthe basics chemical Principle Pragmatically
3. PigeonholePractical problems related to physics and possible solutions
4. Analyze the problem in different areas of in life
5. Conglomerate these basic practical knowledge in arriving at a solution

**Learning Outcomes**

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

1. describe the general laboratory rules and safety procedures;
2. collect scientific data and correctly carrying out chemical experiments;
3. identify the basic glassware and equipment in the laboratory;
4. identify the differences between primary and secondary standards;
5. perform redox titration;
6. record observations and measurements in the laboratory notebooks; and
7. analyse the data to arrive at scientific conclusions.

**Course Contents**

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

**Minimum Academic Standards**

Chemistry Labs and Classes along with the NUC-MAS requirement facilities.

**1.6 BUK-CHM 108: General Chemistry Practical II (1 Unit C: PH 45)**

**Senate- approved relevance**

Bayero University Kano’s vision is *to lead in research and education in Africa*. Hence the need to produce graduates that are equipped with knowledge of Physics in everyday life who are expected to develop capacity of questioning and rational thinking that will provide answers to societal challenges through the conduct of pivotal researches for the improvement and protection of life. General Chemistry is one of the pivotal course that shape Physics Graduates. This course is used to set the foundation of Nuclear Physicist, Radiation Physics, and many other areas of Physics.

**Overview**

The module provides an overview of the rudimentary Practical Chemistry Knowledge, that a scientist will need in the future. This course help in setting the ball rolling starting from the very basics of Atoms to how the react with matter. Atoms, molecules, elements and compounds and chemical reactions will be discussed exhaustively. Principles in elementary chemistry like Elementary thermochemistry. rates of reaction, equilibrium and thermodynamics, will aid the graduates in myriads ways. Topics like Acids, bases and salts. Properties of gases. Redox reactions and introduction to electrochemistry. Radioactivity, will pave way for courses in Physics like Thermal Physics, Modern Physics, Electronics circuits, Analytical mechanics, Geophysics and many more. These and other Basics scientific topics all combined with the laws of physics will shape the graduate in critical thinking and objective analyses.

**Learning Objectives**

1. Enlighten the principles/laws/theorems and evaluate them in the simplest applicable method(s)
2. Establish the basics chemical Principle Pragmatically
3. Pigeonhole Practical problems related to physics and possible solutions
4. Analyze the problem in different areas of in life
5. Conglomerate these basic practical knowledge in arriving at a solution

**Learning Outcomes**

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

1. identify the general laboratory rules and safety procedures;
2. collect scientific data and correctly carrying out Chemical experiments;
3. identify the basic glassware and equipment in the laboratory;
4. identify and carry out preliminary tests which includes ignition, boiling point, melting point, test on known and unknown organic compounds;
5. execute solubility tests on known and unknown organic compounds;
6. execute elemental tests on known and unknown compounds; and
7. conduct functional group/confirmatory test on known and unknown compounds which could be acidic / basic / neutral organic compounds;

**Course Contents**

Continuation of BUK-CHM 107. Additional laboratory experiments to include functional group analysis, quantitative analysis using volumetric methods.

**Minimum Academic Standards**

Chemistry Labs and Classes along with the NUC-MAS requirement facilities.

**1.7 BUK-BIO 101: General Biology I (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 B. Sc. Physics who are knowledgeable in basics Sciences.

**Overview**

The module provides an overview of the fundamentalGeneral Biology Knowledge, that a scientist will need in the future. This course help in setting the ball rolling starting from the very basics of life science. Principles in elementary Biology, will aid the graduates in myriads ways. Topics likeCell structure and organisation, and functions of cellular organelles. General reproduction. interrelationships of organisms (competitions, parasitism, predation, symbiosis, commensalisms) will aid some courses in Physics like Biophysics, Medical Physics, Nuclear Physics, Thermal Physics, Modern Physics, Electronics circuits, and many more. These and other Basics scientific topics all combined with the laws of physics will shape the graduate in critical thinking and objective analyses.

**Learning Objectives**

1. Identify the Cell structure and organisation
2. Elaborate on functions of cellular organelles
3. Pigeonhole Characteristics and classification of living thingsrelated to physics and possible solutions
4. Analyze the General reproduction. interrelationships of organisms
5. Enumerate advantages of competitions, parasitism, predation, symbiosis, commensalisms,
6. Conglomerate these basic of Biology in arriving at an application in Physics e.g. BioPhysics.

**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 the interrelationship that exists between organisms; 5.discuss the concept of heredity and evolution; and

6.enumerate habitat types and their characteristics.

**Course Contents**

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

**Minimum Academic Standards**

Biology Labs and Classes along with the NUC-MAS requirement facilities.

**1.8 BUK-BIO 102: General Biology II (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 B. Sc. Physics who are knowledgeable in basics Sciences.

**Overview**

The module provides an overview of the fundamental General Biology Knowledge, that a scientist will need in the future. This course help in setting the ball rolling starting from the Basic characteristics, identification and classification of viruses, bacteria and fungi. Atoms, molecules, elements and compounds and chemical reactions will be discussed exhaustively. Principles in elementary chemistry like Elementary thermochemistry. A generalized survey of the plant and animal kingdoms based mainly on the study of similarities and differences in the external features. Ecological adaptations. These topics will aid some courses in Physics like Biophysics, Medical Physics, Nuclear Physics, Thermal Physics, Modern Physics, Electronics circuits, and many more. These and other Basics scientific topics all combined with the laws of physics will shape the graduate in critical thinking and objective analyses.

**Learning Objectives**

1. List examples of viruses, bacteria and fungi
2. Elaborate on Basic characteristics, identification and classification of viruses, bacteria and fungi.
3. CubbyholeCharacteristics and classification of living things related to physics and possible solutions
4. AnalyzeEcological adaptations.
5. Briefs on physiology to include nutrition, respiration
6. Conglomerate these basic of Biology in arriving at an application in Physics e.g. BioPhysics.

**Learning Outcomes**

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

1. List the characteristics, methods of identification and classification of viruses, bacteria and fungi;
2. state the unique characteristics of plant and animal kingdoms;
3. describe ecological adaptations in the plant and animal kingdoms;
4. explain nutrition, respiration, excretion and reproduction in plants and animals; and
5. describe growth and development in plants and animals.

**Course Contents**

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

**Minimum Academic Standards**

Biology Labs and Classes along with the NUC-MAS requirement facilities.

**1.9 BUK-BIO 107: General Biology Practical I (1 Unit C: 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 B. Sc. Physics who are knowledgeable in basics Sciences.

**Overview**

The module provides an overview of the fundamental General practicalsKnowledge, that a scientist will need in the future. This course help in setting the ball rolling starting from the very basics pragmatic life activities. Simple identifications of cells, practical equipments, usage and precautions. Common laboratory hazards. prevention and first aid. measurements in biology. uses and care of microscope. compound and dissecting microscope, are some of the topics to be discussed.

**Learning Objectives**

1. Identify Common laboratory hazards
2. Elaborate on prevention and first aid
3. Pigeonhole Biological drawings and illustration
4. Analyze the measurements in biology
5. Enumerate advantages of competitions, parasitism, predation, symbiosis, commensalisms,
6. Conglomerate these basic of Biology in arriving at an application in Physics e.g. BioPhysics.

**Learning Outcomes**

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

1. outline common laboratory hazards;
2. provide precaution on laboratory hazards;
3. state the functions of the different parts of microscope;
4. use the microscope and describe its maintenance;
5. draw biological diagrams and illustrations; and
6. apply scaling and proportion to biological diagrams.

**Course Contents**

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

**Minimum Academic Standards**

Biology Labs and Classes along with the NUC-MAS requirement facilities.

**1.20 BUK-BIO 108: General Biology Practical II (1 Unit C: 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 B. Sc. Physics who are knowledgeable in basics Sciences.

**Overview**

The module provides an overview of the fundamental General Biology Knowledge, that a scientist will need in the future. Principles in life science will aid the graduates in myriads ways. Topics likeprimary vegetative body will aid some courses in Physics like Biophysics, Medical Physics, Nuclear Physics, Thermal Physics, Modern Physics, Electronics circuits, and many more. These and other Basics scientific topics all combined with the laws of physics will shape the graduate in critical thinking and objective analyses.

**Learning Objectives**

1. Identify the anatomical structure and flowering plants
2. Elaborate on primary vegetative body
3. Pigeonhole Characteristics and classification of collenchyma, sclerenchyma, xylem and phloem
4. Analyze the Dissection and general histology of animal tissues
5. Enumerate advantages of stem, leaf and root to show the mature tissues namely parenchyma
6. Conglomerate these basic of plant biology in arriving at an application in Physics e.g. Biophysics.

**Learning Outcomes**

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

1. describe the anatomy of flowering plants;
2. differentiate types of fruits and seeds;
3. state ways of handling and caring for biological wares; 4.describe the basic histology of animal tissues; and
4. identify various groups in the animal kingdom.

**Course Contents**

Anatomy of flowering plants, primary vegetative body. stem, leaf and root to show the mature tissues namely parenchyma, collenchyma, sclerenchyma, xylem and phloem. Types of fruits and seeds. Care and use of dissecting kits and other biological wares. Dissection and general histology of animal tissues based on vertebrate forms. Morphology and functions of epithelial, muscular, nervous and connective tissues. Examination of various groups of lower invertebrates under microscopes, identification of various groups of organisms in Animal Kingdom and any experiment designed to emphasize the practical aspects of topics in BIO 102.

**Minimum Academic Standards**

Biology Labs and Classes along with the NUC-MAS requirement facilities.

1. **Level Two (2) B.Sc. Physics Course Content**

Some of the this level course (2.10 – 2.30) were also adopted from 70% CCMAS , while the remain (2.40 & 2.50) are new courses

**2.10 BUK-COS 201: Computer Programming I (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 (**Computer Programming I**) is designed with the aim of producing graduates in B. Sc. Physics who are knowledgeable in basics Sciences in line with modern trend of programming and quantum computing.

**Overview**

The module provides an overview of the fundamental Computer Programming knowledge, that a scientist will need in the present and future.Computer Programmingwill aid the graduates in myriads ways. Topics likeIntroduction to computer programming, Functional programming; Declarative programming will aid some courses in Physics like Mathematical Physics, Computational Physics, Nuclear Physics, Advance electricity and Magnettism, Modern Physics, Electronics circuits, and many more. These and other Basics scientific topics all combined with the laws of physics will shape the graduate in critical thinking and objective analyses.

Introduction to computer programming. Functional programming; Declarative programming; Logic programming; Scripting languages. Introduction to object-orientation as a technique for modelling computation. Structured, and even some level of functional programming principles; Introduction of a typical object-oriented language, such as Java; Basic data types, variables, expressions, assignment statements and operators

**Learning Objectives**

1. Enumerate various Computer programmes
2. Elaborate on the algorithm and computer languages to be employed
3. Pigeonhole Characteristics and classification of the different Declarative programs
4. Analyze the Basic data types
5. DistinguishQueue from API
6. Elaborate on Scripting languages

**Learning Outcomes**

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

1. Explain the principles of good programming and structured programming concepts;
2. Explain the programming constructs, syntax and semantics of a higher-level language;
3. Describe the chosen programming language variables, types, expressions, statements and assignment; simple input and output;
4. Describe the programme control structures, functions and parameter passing, and structured decomposition; and
5. Develop simple programmes in the taught programming language as well as debug and test them.

**Course Contents**

Introduction to computer programming. Functional programming; Declarative programming; Logic programming; Scripting languages. Introduction to object-orientation as a technique for modelling computation. Structured, and even some level of functional programming principles; Introduction of a typical object-oriented language, such as Java; Basic data types, variables, expressions, assignment statements and operators; Basic object-oriented concepts: abstraction; objects; classes; methods; parameter passing; encapsulation. Class hierarchies and programmeorganisation using packages/namespaces; Use of API – use of iterators/enumerators, List, Stack, Queue from API; Searching; sorting; Recursive algorithms; Event-driven programming: event handling methods; event propagation; exception handling. Introduction to Strings and string processing; Simple I/O; control structures; Arrays; Simple recursive algorithms; inheritance; polymorphism.

**Lab work**: Programming assignments; design and implementation of simple algorithms, e.g., average, standard deviation, searching and sorting; developing and tracing simple recursive algorithms. Inheritance and polymorphism.

**Minimum Academic Standards**

Computer Labs and Classes along with the NUC-MAS requirement facilities.

**2.20 BUK-MTH 201: Mathematical Methods 1 (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 (**Mathematical Methods 1**) is designed with the aim of producing graduates in B. Sc. Physics who are knowledgeable in fundamental Physics, Mathematical tool employed in Statistical and Thermal Physics, modern trend of programming and quantum computing.

**Overview**

The module provides an overview of the fundamental Computer Programming knowledge, that a scientist will need in the present and future.Computer Programmingwill aid the graduates in myriads ways. Topics like**Mathematical Methods 1**, Functional programming; Declarative programming will aid some courses in Physics like Mathematical Physics, Computational Physics, Nuclear Physics, Advance electricity and Magnettism, Modern Physics, Electronics circuits, and many more. These and other Basics scientific topics all combined with the laws of physics will shape the graduate in critical thinking and objective analyses.

**Learning Objectives**

1. Enumerate various Computer programmes
2. Elaborate on the algorithm and computer languages to be employed
3. Pigeonhole Characteristics and classification of the different Taylor series expansion
4. Analyze the Basic data types
5. Distinguish line integralfrom surface integral
6. Elaborate on real variable

**Learning Outcomes**

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

1. Elaborate more on real-valued functions of a real variable;
2. solve some problems using mean value theorem and Taylor series expansion; and
3. Evaluate line integral, surface integral and volume integrals.
4. Application of Taylor series expansion in real value functions
5. Intricate on Line, Area and Volume expansion in fluid dynamics

**Course Contents**

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

**Minimum Academic Standards**

Mathematics Classes along with the NUC-MAS requirement facilities.

**2.30 BUK-MTH 202: Elementary Differential Equations (2 Units C: LH 30)**

**Senate- approved relevance**

Bayero University Kano’s vision is*to lead in research and education in Africa*. Hence the need to produce graduates that are equipped with knowledge of Physics in everyday life who are expected to develop capacity of questioning and rational thinking that will provide answers to societal challenges through the conduct of pivotal researches for the improvement and protection of life. Elementary Differential Equations will widen the horizon of the graduates on the fluid dynamics, Laminar Analyses base on Reynolds Number, modern space exploration, theoretical basis of physical laws and pragmatic telecommunications.

**Overview**

The module provides an overview of the differential equation’sprocesses that lead to the comprehension of applied Physics. We look at the derivatives from primitive geometry, forces thatdetermine air motion (wind), and the behavior of dry and moist air mathematically.

The mathematical implications on how we describe physics theory/behaviors of matter will be observed and measured, Satellite Communications, andhow those measurements are combined with the laws of physics to provide aweather forecast.

Derivation of differential equations from primitive geometry, physics etc. Order and degree of differential equation. Techniques for solving first and second order linear and non-linear equations. Solutions of systems of first order linear equations. Finite linear differential equations. Application to geometry and physics.

**Learning Objectives**

**1**Intricate onDerivation of differential

2. The mathematical models employed in weather forecast will be demostrated

3. ExplainTechniques for solving first and second order linear and non-linear equations,

4. Elaborate on Order and degree of differentiation,

5. Application to geometry and physics.

**Learning Outcomes**

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

1. define the following: order and degree of a differential equation;
2. describe some techniques for solving first and second order linear and non-linear equations; and
3. Solve some problems related to geometry and physics.
4. List different order of differential equation with examples
5. Solve First and second order linear and Nonlinear equations

**Course Contents**

Derivation of differential equations from primitive geometry, physics etc. Order and degree of differential equation. Techniques for solving first and second order linear and non-linear equations. Solutions of systems of first order linear equations. Finite linear differential equations. Application to geometry and physics.

**Minimum Academic Standards**

Mathematics Classes along with the NUC-MAS requirement facilities.

**2.40 BUK-PHY-201Introduction to space science (2 Units C: LH 30)**

**Senate- approved relevance**

Bayero University Kano’s vision is*to lead in research and education in Africa*. Hence the need to produce graduates that are equipped with knowledge of Physics in everyday life who are expected to develop capacity of questioning and rational thinking that will provide answers to societal challenges through the conduct of pivotal researches for the improvement and protection of life. Introduction to space science will widen the horizon of the graduates on the modern space exploration, theoretical basis of physical laws and pragmatic telecommunications.

**Overview**

The module provides an overview of the astronomy and Astrophysicsprocesses that lead to the weather we experience. We look at the forces thatdetermine air motion (wind), and the behavior of dry and moist air (cloudsand rain).

We describe how the atmosphere is observed and measured,Satellite Communications, andhow those measurements are combined with the laws of physics to provide aweather forecast.

**Learning Objectives**

**1**. Be familiarize withastronomy and Astrophysics

2. DevelopSatellite Communicationsprogrammes

3. Explain atmospheric Science, Space environment, space craft and dynamics,

4. IdentifyAero/Astrodynamic principles to be applied in engineering,

5. Briefly elaborate on Cosmology, Origin of Universe and life, Space law and Business development

**Learning Outcomes**

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

1. provide a qualitative description of the solar system from origin to present state;
2. apply dynamical principles to understand phenomena such as tides and orbits in the solar system;
3. carry out a simple orbit calculation, based on energy and angular momentum conservation on the basis of Kepler's laws and the Virial theorem;
4. describe the nature of the sun by considering it as a black body and body in hydrostatic equilibrium;
5. explain the basic principles behind the energy generation in the sun;
6. describe the nature of planetary atmospheres and explain the origin of the Earth's greenhouse effect;
7. describe the internal constituents of the planets;
8. explain how planetary ring systems may be formed;
9. state the consequences of planetary interaction in the solar system; and
10. explain the evolution of the solar system.

**Course Content**

Introduction to astronomy and Astrophysics, Satellite Communications, Introduction to atmospheric Science, Space environment, space craft and dynamics, Aero/Astrodynamic Engineering, Cosmology, Origin of Universe and life, Space law and Business development

**Minimum Academic Standards**

Level 1 and 2 Physics laboratory with a NUC-MAS requirement facilities.

**2.50 BUK-PHY-202Introduction to Data Science (2Units C LH: 30)**

**Senate Approved Relevance**

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*. Introduction to Data Science will help inproducing graduates that can collect, analyze and extrapolate data for present and future use. The course will also widen the horizon of the graduates on the current software tools and method of analyses alongside theoretical basis of physical laws and principles upon which some devices operate.

**Overview**

The module provides an overview of Data Science and its interpretations; Probability distributions; Parameter Estimation and the atmosphere and maximum likelihood & extended maximum likelihood. We describe how the atmosphere is observed and measured, andhow those measurements are combined with the laws of physics to provide aweather forecast.

**Objectives**

**1**. To introduce basics of statistical methods and modern-day advanceddata analysis techniques, as required in all fields working with data.

2. To deepen the understanding of how data analysis works for small and large data samples.

3. To obtain a comprehensive set of tools to analyse data.

**Learning Outcomes**

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

1. describe the processes and effect of interactions of radiation with matter;
2. explain the concept of electricity and magnetism at the cellular levels;
3. illustrate and explain the effect of impulse in nerves and muscles; and

4.explain solute transport in membranes.

**Course Contents**

Probabilities and interpretations; Probability distributions; Parameter Estimation; Maximum Likelihood and extended maximum likelihood; Least Square, chi-square, correlations; Monte Carlo basics; Probability and confidence level; Hypothesis testing; Goodness of fit tests; Limit setting; Introduction to Multivariate Analysis Techniques;

**Minimum Academic Standards**

Level 1 and 2 Physics laboratory with a NUC-MAS requirement facilities.

**Level Three (3) B.Sc. Physics Course Content**

One of this level course (3.10 and 3.80) were adopted from 70% CCMAS while the remaining (3.20 – 3.90) are all new courses added to the 30% CCMAS.

3.**10 BUK-MTH 304: Complex Analysis (2 Units C: LH 30)**

**Senate- approved relevance**

This course (Complex Analysis), will help the graduate to key into the real and imaginary number frames of references. This will help to bridge the between the elementary mathematics and the actual life utility of the physics principles in general day to day human endeavors

**Overview**

The module provides an overview of number system in the real and complex frames, functions of complex variable, varaiation and derivative of Cauchy-Riemann equations and conformal mapping. This will help our graduate in the real of theoretical physics, geophysics and general Physics.

**Learning Objectives**

**1**. Introduce functions of complex variable

2. Evaluate and derive Cauchy-Riemann equations

3. Obtain a comprehensive method of using conformal mapping

4. Assess real life simple problems involving contour integrals

5. Unravel some problems involving, Power and Taylor series of function of a complex variable.

**LearningOutcomes**

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

1. define functions of complex variable;
2. derive Cauchy-Riemann equations;
3. discuss conformal mapping;
4. solve some problems involving contour integrals, Power and Taylor series of function of a complex variable.
5. Apply complex functions, Cauchy-Riemann equations and other mathematical principle to Physics

**Course Contents**

Functions of a complex variable. Limits and continuity of functions of a complex variable. Derivating the Cauchy-Riemann equations. Analytic functions. Bi-linear transformations, conformal mapping, contour integrals. Cauchy’s theorems and its main consequences, convergence of sequences and series of functions of a complex variable. Power series. Taylor series.

**Minimum Academic Standards**

Mathematic Classes along with the NUC-MAS requirement facilities.

**3.20 BUK-PHY -301 ARTISENAL PHYSICS (2 Unit C, 30 LH)**

**Senate- approved relevance**

This course (Artisenal Physics), will help the graduate to key into the real industrial hub of Kano state by utilizing the knowledge obtained to their developed capacity by comprehending todays society problems and providing pragmatic and realistic model solutions.

**Overview**

The course brings the student into direct contact with the general field application and economic aspect of physics. It gingers the curiosity of student to direct use of physics in day to day life thereby provokes the interest of application and partnering/participation in the development of the various trades. The course bridges the gap between classwork/laboratory work and the real life applications of the physics.

**Learning Objectives**

The learning objectives of the course are as follows:

1. Bridge the between the class learning activities and the actual life utility of the physics principles in general day to day human endeavors
2. Augment the knowledge of student with industry level equipment so as reduce the pressure enforced by shortage practical equipment
3. Inculcate the zeal in student for application of physics beyond the confine of the university and inject more confidence in the student towards physics applications.
4. Provide a broader outlook on the ability of student by challenging his/her intellectual ability thereby provoke his interest in the various trades.
5. Reduce the ego of student to the level of appreciating the marketability physics beyond the academic environment.

**Learning Outcomes**

The learning outcomes of the course are as follows:

1. The student shall demonstrate the utility of physics principles in various forms as used by various artisans
2. The student shall see those artisans as part of the economy, as activities which can be taken as livelihood job for graduates.
3. The student shall show interest and execute the trades with the zeal for and ability to bring about the required improvement
4. The student shall where possible develop a project on improvement of the trade based on physics principles.
5. Reduce the ego of student to the level of appreciating the marketability physics beyond the academic environment.

**Course Contents**

Student groups are assigned to some selected trades on bi-weekly basis under a supervisor. Each student will be expected to provide a well-structured report based on the requisite principles of physics behind the application of the trade, deficiencies of the trade and how physics can be exploited in the improvement of the trade. Detailed theories and applications of the principles with supportive figures and plates must be included in the report. The report shall cover both financial and material aspects. The report content, interest and innovation as well as participation will be assessed by the supervisor.

**Minimum Academic Standards**

Physics Classes, Kano Market, industries, society, and the NUC-MAS requirement facilities.

**3.30BUK-PHY 302: Vector and Tensor Analysis (2 Units C: LH 30)**

**Senate- approved relevance**

To graduate students that are introduced toVector and Tensor Analysis. The graduate are expected to develop critical thinking and optimum capacity of questioning and rational thinking that will enable utilization of mathematical models and tensor analyses in the technological improvement of life to fulfil the mission and vision of Bayero University, Kano. The course will ground the graduate in higher order analysis of real time complex situations by providing simple soltutions to be employed in automobile, hospital and environmental safety.

**Overview**

The module provides an overview of the Vectors and Tensors. This processes can lead tothe describe gradient, divergence and curl, hence solving some problem by applying the Green’s Stoke theorem.

**Objectives**

**1**. Presentvector differentiation and vector integration;

2. Appreciate the application of gradient, divergence and curl

3. Cleverly employ Green’s, Stoke’s and divergence theorems

4. Solve some problems involving applications of vector differentiation and vector integration; and

5 Discuss tensor and Cartesian tensor.

**LearningOutcomes**

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

1. discuss vector differentiation and vector integration;
2. describe gradient, divergence and curl;
3. discuss Green’s, Stoke’s and divergence theorems;
4. solve some problems involving applications of vector differentiation and vector integration; and
5. Discuss tensor and Cartesian tensor.

**Course Contents**

Introduction to vectors and tensors calculus, Indent notation, tensor concepts, coordinate transformation, special tensors and coordinate transformation, Vector differentiation and applications. Gradient, divergence and curl. Vector integration, line, surface and volume integrals, Greens, Stoke’s and divergence theorems. Tensor products of vector spaces. Tensor algebra. Symmetry. Cartesian tensors.

**Minimum Academic Standards**

Physics Classes along with the NUC-MAS requirement facilities.

**3.40 BUK-PHY-303: Biophysics (2 Units C: LH 30)**

**Senate Approved Relevance**

To graduate students that are introduced how physics can be use in life science. They are expected to comprehend the process and areas physics can be use to improve our life standards. The graduate should vividly see at the surface how physics can be found in the following areas: radiography, tomography, Linear energy transfer, Imaging, Nuclear Magnetic Resonance and many morefor the technological improvement of life to fulfil the mission and vision of Bayero University, Kano. The course will widen the understanding of the graduates on the operations of embedded systems and principles upon which embedded devices operate with a view to reproduce and or modify the devices, leading to identification and development of new devices and application areas.

**Overview**

The course provides an introduction to Molecules and Cells.,Mesoscopic forces, and Phase transitions. It also provides a basis for understanding suitable Chemical kinetics. Enzyme kinetics and System biology to be applied in real life.

**Learning Objectives**

**1**. To introduce basics of statistical methods and modern-day advanceddata analysis techniques, as required in Life Science.

2. To deepen the understanding of processes and effect of interactions of radiation with matter

3. To explain the concept of electricity and magnetism at the cellular levels

4. Enumerate Enzyme Kinetics

5. Evaluate Linear Energy Transfer

**Learning outcomes**

On completion successful students will be able to:

1. demonstrate an understanding of the basics of the biophysics.
2. Explain methods of interaction of matter and radiation.
3. Apply a set of analysis techniques as required for basic and advanced datasets.
4. Critically assess new results derived from datasets.
5. Use the knowledge of biophysics to solve the transport in membranes.
6. describe the processes and effect of interactions of radiation with matter;
7. explain the concept of electricity and magnetism at the cellular levels;
8. illustrate and explain the effect of impulse in nerves and muscles; and
9. explain solute transport in membranes.

**Course Contents**

Molecules and Cells. Mesoscopic forces. Phase transitions. Motility. Aggregating and selfassembly. Surface phenomena. Biomacromolecules. Charged ions. Polymers. Membranes. Rheology. Sensory motors. Chemical kinetics. Enzyme kinetics. System biology. Spikes. Physiology of cells and organisms. Biological sensors. Ionization of biomolecules. Thermodynamic principles. Energy transfer in living systems. Bioelectricity (ion channels, action potentials nerve impulse transmission).

**Minimum Academic Standards**

Physics Classes along with the NUC-MAS requirement facilities.

**3.50 BUK-PHY-304 Introduction to Acoustics (2Units E LH:30)**

**Senate Approved Relevance**

To produce graduates that are equipped with Basic knowledge ofAcousticsand its area of applications in everyday life. The graduate is expected to identify areas of exploration and employ this kowldge again, for the improvement and protection of life in line with the mission and vision of Bayero University, Kano. The course will widen the horizon of the graduates on the theoretical basis of physical laws and principles upon which some devices operate with a view to reproduce and or modify the devices, leading to identification and development of new devices and application areas.

**Overview**

The course will brings the student into direct contact with the theories and general field applications. The knowledge will gingers the curiosity of student to direct use of physics in day to day life thereby provokes the interest of application and partnering/participation in the development of the various research and innovation. The course will bridges the gap between classwork/laboratory work and the real life applications of the physics.

**Learning Objectives**

1. Explain the significance of acoustics in our daily life
2. State the principles of vibrations
3. List the different types of musical instruments
4. Identify the different types of optical instruments
5. Describe the eye and its functions
6. Mention the different types of eye defects

**Learning outcomes**

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

1. Explain the concepts of vibration and waves
2. Differentiate between force oscillation and coupled oscillation
3. Identify the characteristics of notes and properties of sound
4. Describe resonance
5. Identify optical instruments and some eye defects

**Course Contents**

Vibration and waves; Simple harmonic motion, mechanical waves, wave functions, superposition of two SHM along the same line, superposition of SHM at right angle. Force oscillators; Coupled oscillation; Sound wave; velocity of sound, Intensity of sound, characteristics of notes, and properties of sound, resonance in a tube or pipe of sound, resonance in a tube or pipe. Optical instruments; Eye and eye defects

**Minimum Academic Standards**

Physics Classes along with the NUC-MAS requirement facilities.

**3.60 BUK-PHY 305: Introduction to Geophysics (2Unit ELH:30)**

**Senate Approved Relevance**

Introduction to Geophysics will produce graduates that are equipped with Basic knowledge of geology and its exploration, and its area of applications in everyday life. The graduate is expected to identify areas of mining, water (hydrogeology) and employ this knowledge, for the improvement and protection of life in line with the mission and vision of Bayero University, Kano. The course will widen the horizon of the graduates on the theoretical basis of physical laws and principles upon which some devices operate with a view to reproduce and or modify the devices, leading to identification and development of new devices and application areas.

**Overview**

The course will brings the student into direct contact with the theories and general field applications. The knowledge will gingers the curiosity of student to direct use of physics in day to day life thereby provokes the interest of application and partnering/participation in the development of the various research and innovation. The course will bridges the gap between classwork/laboratory work and the real life applications of the physics.

**Learning Objectives**

1. Explain the significance of geophysics in our daily life
2. State the principles of vibrations
3. List the different types of exploration instruments
4. Identify the different types of geophysical instruments
5. Describe the sound and vibration and their functions
6. Mention the different types of detectors

**Learning outcomes**

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

1. Explain the concepts of vibration and waves
2. Differentiate between force oscillation and coupled oscillation
3. Identify the characteristics of notes and properties of sound
4. Describe resonance
5. Identify optical instruments and some sound defects

**Course Content**

Meaning and significance of geophysics. Origin and geophysical significance of various geophysical methods. Gravity, magnetic. Electrical and radiometric types of geophysical surveys and their importance. Introductory discussion to gravity, k magnets and seismic methods, their instrumentation and simple applications.

**Minimum Academic Standards**

Physics Classes along with the NUC-MAS requirement facilities.

3.70 BUK-PHY-306 Atmospheric Physics & Weather **(2Unit E LH: 30)**

**Senate Approved Relevance**

To graduate students who appreciates dynamics in atmospheric and weather Physics. Energy levels and spectra. Relevance is seen in the understanding of physical world by incorporating relativity, Compton effect to fulfil the mission and vision of Bayero University, Kano.

**Overview**

The course introduces the concept ofDensity currents and diffusion processes. It also provides an introduction to the principles of Ekman spiral; scale heights , energy transport and their usage in deriving relations for structure of the ionosphere and plasmasphere; regular and irregular variations.

**Learning Objectives**

**1**. Introduce Density currents and diffusion processes in the sea.

2. Deepen the understanding of coriolis force; eddy conductivity and viscosity;

3. Explainthe oceanic thermocline and nutrient circulation.

4. Assimilate oxygen and carbon in the dynamics of the atmosphere and biosphere;

5. Elaborate on the understanding of C-14 dating;

**Learning outcomes**

On completion successful students will be able to:

1. demonstrate an understanding of C-14 dating.
2. Explain oxygen and carbon in the dynamics of the atmosphere and biosphere
3. Apply a set of analysis techniques as required for basic and advanced datasets.
4. Critically elaboration on coriolis force; eddy conductivity and viscosity.
5. Use this knowledge to understand more advanced and new techniques.

**Course Content**

Density currents and diffusion processes in the sea, the coriolis force; eddy conductivity and viscosity; the oceanic thermocline and nutrient circulation; wind driven currents in deep water and in the atmosphere; variation of velocity and direction with altitude; the Ekman spiral; scale heights and energy transport; water movements in bounded seas and estuaries; effect of ice formation on currents; waves in deep and shallow water; tides; optical transmission and photosynthesis; acoustic transmission in the ocean; the atmosphere as a gas mixture in a gravitational field; hydrostatic equilibrium; dadiative equilibrium and lapse ratter; escape of atmospheric gases; photochemistry of the upper atmosphere; oxygen and carbon in the dynamics of the atmosphere and biosphere; C-14 dating; microclimate; electric sources; global and local atmospheric circulation; the ionospheric layer and the Chapman model; the plasma frequency; collision and absorption; structure of the ionosphere and plasmasphere; regular and irregular variations

**Minimum Academic Standards**

Physics Classes along with the NUC-MAS requirement facilities.

**3.80 BUK-PHY316: Circuit Theory (2 Units C: LH 30)**

**Senate Approved Relevance**

To graduate students who appreciates electronic circuit. The theory involve in circuit design, Energy levels and spectra. Relevance is seen in the understanding of physical world by incorporating digital era (electronics), to fulfil the mission and vision of Bayero University, Kano.

**Overview**

The course introduces the concept ofcontinuous and discrete signals and systems, performance, efficiency and availability constraints, and diffusion processes. It also providestrending computer, mathematical and simulation programmes.

**Learning Objectives**

1. Introduce proper network reduction techniques.
2. Deepen the understanding circuital laws and theorems for magnetic/electric circuit solution considering economic, performance, efficiency and availability constraints;
3. Introduce and elaborate onthe different types of attenuators and filters.
4. Assimilate circuits and systems by their standard parameters
5. Elaborate on how to develop various methodology/strategies base on their operation under different operating conditions;

**Learning Outcomes**

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

1. identify proper network reduction techniques, circuital laws and theorems for magnetic/electric circuit solution considering economic, performance, efficiency and availability constraints;
2. estimate parameters for different types of attenuators and filters used in signal modulation for power systems and communication systems;
3. analyse circuits and systems by their standard parameters to identify their characteristics in general form, applicable for generation, transmission and distribution considering economical, ethical and practical limitation;
4. develop various methodology/strategies through various domain of analysis to evaluate performance characteristics of electrical networks and analyse their operation under different operating conditions for various electrical /electromagnetic systems; and
5. apply computer mathematical and simulation programmes to various real life multidisciplinary topics through circuit solution.

**Course Contents**

Laplace and Fourier transformations, application of Laplace transformation to transient analysis of RLC circuits, transfer function concept, reliability of transfer functions, Foster and Cauer’s methods of synthesis 2-port network synthesis, active filters. Analysis of continuous and discrete signals and systems, families. Concepts of small, medium, large and very large scale integration and their consequences. Some digital building blocks; flip-flops, counters, register, and decoders. Introduction to D/A and A/D conversion principles. Approximation to non-linear characteristics, analysis and synthesis of non-linear resistive circuits, harmonic analysis of non-linear dynamical circuits, transient states in non-linear circuits, applications of computers in the analysis of linear and non-linear circuits.

**Minimum Academic Standards**

Physics Classes along with the NUC-MAS requirement facilities.

1. **Level Four (4) B.Sc. Physics Course Content**

**4.10 BUK-PHY-401 Quantum Computing and Programming (2Units C LH:30)**

**Senate Approved Relevance**

To produce graduates that are equipped with knowledge of Quantum Computing ad programming in everyday life who are expected to develop capacity of questioning and rational thinking that will provide answers to societal challenges through the conduct of pivotal researches for the improvement and protection of life in line with the mission and vision of Bayero University, Kano. The course will widen the horizon of the graduates on the theoretical basis of physical laws and principles upon which some devices operate with a view to reproduce and or modify the devices, leading to identification and development of new devices and application areas.

**Overview**

Quantum computing is one of the most intriguing of modern developmentsat the interface of computing, mathematics and physics, whose long termimpact is far from clear as yet. The perspective that quantum phenomena bring to the questions of information and algorithm is quite unlike the conventional one. In particular, selectedproblems which classically have only slow algorithms, have in the quantumdomain, algorithms which are exponentially faster. This course aims to give the student anintroduction to this unusual new field.

**Learning Objectives**

**Learning outcomes**

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

1. Understand the [Basic Introduction to Cirq](#_Toc128751696)
2. Understand the [mathematical notation of a complex number.](#_Toc128751795)
3. Perform the [operations on the unitary operators.](#_Toc128751737)
4. Explain the [Bloch sphere.](#_Toc128751814)
5. Perform the [operations with quantum gates](#_Toc128751737)
6. Understand   [Discrete   Fourier   Transform.](#_Toc128751833)
7. Explain [the types of Discrete Fourier Transform.](#_Toc128751834)
8. Analyze the [Quantum Fourier Transform](#_Toc128751838)

**Course contents**

[Basic of quantum computing](#_Toc128751696): [One Bit](#_Toc128751697), [Coin Flipping](#_Toc128751700), [Probabilistic States](#_Toc128751704), [Probabilistic Operators](#_Toc128751707), [Two Probabilistic Bits](#_Toc128751711), [Correlation](#_Toc128751714), [Operators on Multiple Bits](#_Toc128751715), [Quantum Coin Flipping](#_Toc128751719), [Hadamard Operator](#_Toc128751722), [One Qubit](#_Toc128751724), [Quantum State](#_Toc128751727), [Visualization of a Qubit](#_Toc128751730), [Superposition, and Measurement](#_Toc128751734). [Operations on the Unit Circle](#_Toc128751737): [Rotations](#_Toc128751738), [Reflections](#_Toc128751745), [Reflections in quantum computing](#_Toc128751746), [and Tomography](#_Toc128751749).[Two Qubits](#_Toc128751754), [Entanglement and Superdense Coding](#_Toc128751758), [Quantum Teleportation](#_Toc128751762), [Multiple Control Constructions](#_Toc128751766), [Inversion about the Mean](#_Toc128751770), [Grover's Search](#_Toc128751774), [One Qubit Representation](#_Toc128751778), [Phase Kickback](#_Toc128751781). [Introduction to Cirq](#_Toc128751790): [Complex numbers](#_Toc128751793), [Mathematical notation of complex numbers](#_Toc128751795), [Quantum states](#_Toc128751796),[unitary operators](#_Toc128751800), [Global and relative phases](#_Toc128751805), [Unique Representation](#_Toc128751810), [Bloch sphere](#_Toc128751814), [Single-qubit, quantum gates](#_Toc128751819), [Rotations on Bloch sphere](#_Toc128751823),[Properties of Rotations on Bloch sphere](#_Toc128751824), [Multi-qubit gates](#_Toc128751827), [Discrete Fourier Transform](#_Toc128751833),[Types of Discrete Fourier Transform](#_Toc128751834), [Quantum Fourier Transform](#_Toc128751838).

**Minimum Academic Standards**

Physics Classes along with the NUC-MAS requirement facilities.

**4.20 BUK-PHY-404 NATIONAL ENERGY POLICY (1Unit C LH: 15)**

**Senate Approved Relevance**

To produce graduates that are understand the National Energy Policy in the current everyday life who are expected to develop capacity of questioning and rational thinking that will provide answers to societal challenges through the conduct of pivotal researches for the improvement and protection of life in line with the mission and vision of Bayero University, Kano. The course will widen the horizon of the graduates on the theoretical basis of physical laws and principles upon which some devices operate with a view to reproduce and or modify the devices, leading to identification and development of new devices and application areas.

**Overview**

National Energy Policy is a course that its significance cannot be over emphases. Energy is key to global development as such rational policies need to be put in place to guide the trend clean energy generation in line with the mission and vision of Bayero University, Kano, as well as the UNSDG 2020.

**Learning outcomes**

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

1. Analyse the history of Nigerian energy
2. List and identify the major energy source in Nigeria
3. Explain the different ways of utilization of energy
4. Explain the energy issues in Nigeria
5. Understand the Energy Efficiency and Conservation
6. Explain the Bilateral, Regional, and International Cooperation.
7. Understand the Energy financing
8. Understand the Energy Planning and Policy Implementation

**Course contents**

Energy Sources: Oil, Natural Gas, Tar Sands, Coal, Nuclear, Hydropower, Fuelwood, Solar, Biomass, Wind, Hydrogen, and Other Renewables Energy Utilization, Electricity, Industry, Agriculture, and Transport. Energy Issues, Environment, Energy Efficiency and Conservation, Research, Development, and Training, Bilateral, Regional, and International Cooperation Energy financing; Indigenous participation. Planning and Policy Implementation, Energy Planning, Policy Implementation, and Prioritization of Strategies into Short, Medium, and Long Term.

**Minimum Academic Standards**

Physics Classes along with the NUC-MAS requirement facilities.

**4.30 BUK-PHY 422: Digital Electronics (2 Units C: LH 30)**

**Senate Approved Relevance**

To graduate students that are introduced toDigital electronics who areadequately equipped with relevant circuit laws to analyse simple electric circuits. Relevance is seen in synthesizing electric circuits for the technological improvement of life to fulfil the mission and vision of Bayero University, Kano.

**Overview**

The course provides an introduction to digital aspect of electric circuits. It also provides an advance information to semiconductors necessary for understanding electronics.

**Learning Objectives:** The objectives of the course are to;

1. provide basis for understandingelementary concepts of electric circuit laws;
2. provide basis Switching properties of electronic devices.
3. provide techniques for solving Switching and waveshaping circuits
4. provide basis for determining the Generation of non-sinusoidal waveform.
5. provide Analysis and design of logic gates of various families
6. provide basis for applyingEuler’s method, Taylor series method

**Learning Outcomes**

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

1. identify circuit diagrams and symbols related to Switching and waveshaping circuits;

2. determine current flows, potential drops, power, and energy dissipation in non-sinusoidal waveform;

3. Analysis and design of logic gates of various families

4. state Kirchhoff’s laws and apply same in solving for currents and voltages in dc. and ac. circuits;

5. applyEuler’s method, Taylor series method,

6. state and apply Runge-Kutta, predictors corrector methods, multi-step methods;

7. apply the Mesh currents and Node – Voltage methods in network analysis;

8. discuss the nature of ac. currents and voltages in resistors, inductors, capacitors and determine impedances;

9. analysea.c. circuits using phasor diagrams;

**Course Contents**

Review of elementary concepts. Switching properties of electronic devices. Switching and waveshaping circuits. Generation of non-sinusoidal waveform: astable, monostable and bistablemultivibrators, comparator, Schmitt trigger and time-base generators using discrete transistor, operational amplifier or other integrated circuits. Timer chips and their applications. Analysis and design of logic gates of various families (diode logic, RTL, TTL, ECL, MOS, and CMOS) of digital integrated circuits, interfacing between various logic numerical differentiation and integrations: initial and boundary value problems. Euler’s method, Taylor series method, Runge-Kutta, predictors corrector methods, multi-step methods. Systems of equations and higher order equations. Finite difference calculus: difference equations.

**Minimum Academic Standards**

Physics Classes along with the NUC-MAS requirement facilities.

**4.40 BUK-PHY 406: Modern Optics (2Unit E LH: 30)**

**Senate Approved Relevance**

To produce graduates that are understand the modern Optics , to help in understanding of areas like Photonics and acoustics in the current trends of science and technology, in line with the mission and vision of Bayero University, Kano. The course will widen the horizon of the graduates on the theoretical basis of physical laws and principles upon which some devices operate with a view to reproduce and or modify the devices, leading to identification and development of new devices and application areas.

**Overview**

Modern Optics is very important in Space Science, and Geophysics. In fact one of the most intriguing of modern developmentsat the interface of computing, mathematics and physics, whose long termimpact is far from clear as yet.

**Learning Objectives**

1. To explain the Brillouin scattering;
2. To understand the Energy Efficiency and Conservation
3. To explain the Bilateral, Regional, and International Cooperation.
4. To understand the Energy financing
5. To understand the Energy Planning and Policy Implementation

**Learning outcomes**

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

1. Analyze the thick lenses formula and applications
2. List and identify the telephoto and zoom lenses
3. Explain the different ways of utilization of phase conjugate reflection
4. Explain the Brillouin scattering;
5. Understand the Energy Efficiency and Conservation
6. Explain the Bilateral, Regional, and International Cooperation.
7. Understand the Energy financing
8. Understand the Energy Planning and Policy Implementation

**Course Content**

Thick lenses formula and applications; multi element lens types; telephoto and zoom lenses; telephoto and zoom lenses; analytic ray tracing; aberrations; the Mathieson (gradient of refractive index) lens in fishes; multi element lenses in crustaceans; biological mirrors and mirror eyes opposition and superposition eye; fiber optic and communication; Fourier transform spectroscopy, imaging and optical processing; media Brillouin scattering; phase conjugate reflection; aperture synthesis ; intensity intercommetry; lasers, Cerenkov and synchrotron radiation.

**Minimum Academic Standards**

Physics Classes along with the NUC-MAS requirement facilities.

**4.50 BUK – PHY407: Advanced Analytical Mechanics (2Unit E LH:30)**

**Senate Approved Relevance**

To produce graduates that are understand the Advance Analytical Mechanics, to help in understanding of mechanics and its contains, in the modern trends of science and technology, in line with the mission and vision of Bayero University, Kano. The course will widen the horizon of the graduates on the theoretical basis of physical laws and principles upon which some devices operate with a view to reproduce and or modify the devices, leading to identification and development of new devices and application areas.

**Overview**

Advance Analytical Mechanics is very important in high Physics and Sciences . In fact one of the most crucial topic in critical analysis of our day to day life problem, in relation to computing, mathematics and physics, whose long termimpact is far from clear as yet.

**Learning Objective**

1. To Understand the conservation n laws; mechanical similarity;
2. To Explain the a system of particles; Green’s function;
3. To Explain the principle of least action;
4. To Analyze the Generalized coordinates; List and identify the telephoto and zoom lenses
5. To apply the theLagrangians for a free particle and Understand the Energy Efficiency and Conservation

**Learning outcomes**

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

1. Analyze the Generalized coordinates; List and identify the telephoto and zoom lenses
2. Explain the the principle of least action;
3. Explain the theLagrangians for a free particle and Understand the Energy Efficiency and Conservation
4. Explain the a system of particles; Green’s function;
5. Understand the conservation n laws; mechanical similarity;

**Course Content**

Generalized coordinates; the principle of least action; the Lagrangians for a free particle and a system of particles; Green’s function; conservation n laws; mechanical similarity; the reduced mass; motion in a central force field; Kepler’s problem; rockets; the earth – moon system; elastic and inelastic binary collisions; scattering; time reversal in two body mechanics; small oscillations; vibration of molecules; parametric resonance; non-linear oscillations; equations of motion of a rigid body; the inertia tensor; Euler’s equation; the asymmetric top; non-inertial frames; the coriolis force and geophysical applications; Larmoreffect; Hamilton’s equations; Poisson brackets; canonical transformations; Liouville’s theorem; Hamilton-Jacobi equation; separation of variables.

**Minimum Academic Standards**

Physics Classes along with the NUC-MAS requirement facilities.

**4.60 BUK-PHY408: Atomic and Molecular Spectroscopy (2Unit E LH:30)**

**Senate Approved Relevance**

To produce graduates that are understand the Atomic and Molecular Spectroscopy, to help in understanding of mechanics and its contains, in the modern trends of science and technology, in line with the mission and vision of Bayero University, Kano. The course will widen the horizon of the graduates on the theoretical basis of physical laws and principles upon which some devices operate with a view to reproduce and or modify the devices, leading to identification and development of new devices and application areas.

**Overview**

Atomic and Molecular Spectroscopy is very important in high general Physics and Sciences . In fact one of the most important topic in critical analysis of our day to day health challenges, in relation to computing, mathematics and physics, whose long termimpact is far from clear as yet.

The hydrogen atom; relativistic effects and spin. Identical particles and symmetry. Many electron atoms. Coupling schemes and vector model. Zeeman effect. Hyperfine structure. The diatomic molecule; the Frank-Condon principle. X-ray diffraction. Microwave methods. Resonance phenomena. ESR, NMR and optical pumping and Mossauer scattering.

**Learning Objective**

1. To Understand the hydrogen atom;;
2. To Explain the relativistic effects and spin;
3. To Explain theIdentical particles and symmetry;
4. To Analyze the Zeeman effect
5. To apply the X-ray diffraction

**Learning outcomes**

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

1. Analyze the atomic and molecular structure of matter
2. Explain Microwave methods.
3. Explain pumping and Mossauer scattering
4. Explain the Frank-Condon principle;
5. Understand the hydrogen atom;;

**Course Content**

The hydrogen atom; relativistic effects and spin. Identical particles and symmetry. Many electron atoms. Coupling schemes and vector model. Zeeman effect. Hyperfine structure. The diatomic molecule; the Frank-Condon principle. X-ray diffraction. Microwave methods. Resonance phenomena. ESR, NMR and optical pumping and Mossauer scattering.

**Minimum Academic Standards**

Physics Classes along with the NUC-MAS requirement facilities.

**4.70BUK-PHY411: Nuclear and Particle Physics (3Units E LH:45)**

**Senate Approved Relevance**

To produce graduates that are understand the Nuclear and Particle Physics , to help in assimilating the basic fabric of the earth and the trend in its emolument. The content will pave ay for the graduates to explore knowledge that will shape the future. Some of them are nucleo-sythesis, Resonance, Imaging and Medical Physics., in the modern trends of science and technology, in line with the mission and vision of Bayero University, Kano. The course will widen the horizon of the graduates on the theoretical basis of physical laws and principles upon which some devices operate with a view to reproduce and or modify the devices, leading to identification and development of new devices and application areas.

**Overview**

Current million development goal and the UNSDG give priority to environment, clean energy and affordable access clean water. The knowledge of this course will help emensely in guiding the graduate in achieving the aforementioned goals. It is with no doubt a very important in course in Physics and Sciences . In fact one of the most crucial topic in critical analysis of our day to day life problem, in relation to computing, mathematics and physics, whose long termimpact is far from clear as yet.

**Learning Objectives**

1. To explain the Nucleus and its constituents
2. To understand how energy can be generate via Fission and fusion;
3. To elaborate on the Unification theories
4. To Explain the application of nuclear physics in medicine , Artifacts, Oceans etc.

Understand the conservation n laws; mechanical similarity;

**Learning outcomes**

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

1. Understand the Nucleus and its constituents
2. Explain how energy can be generate via Fission and fusion;
3. Explain the Unification theories
4. Explain the application of nuclear physics in medicine , Artifacts, Oceans etc.
5. Understand the conservation n laws; mechanical similarity;

**Course Content**

Nuclear structure; Nuclear properties, nuclear size, nuclear masses; nuclear forces, nucleon-nucleon scattering; the deuteron. Nuclear models. Radioactive decay: alpha, beta, gamma decays. Nuclear reactions. Nuclear Instrumentations and radiation detection techniques; detectors. Nuclear spectroscopy. Neutron physics: Production and detection of neutrons. Fission and fusion. Nuclear reactor and nuclear energy. Elementary particles: Conservation laws, particle classification. Strong, electromagnetic, and weak interactions. Resonances.

**Minimum Academic Standards**

Physics Classes along with the NUC-MAS requirement facilities.

**4.80 BUK-PHY 412: Acoustics (2Unit E LH: 30)**

**Senate Approved Relevance**

To produce graduates that are equipped with advance knowledge of Acoustics and its area of applications in everyday life. The graduate is expected to identify areas of exploration and employ this knowledge again, for the improvement and protection of life in line with the mission and vision of Bayero University, Kano. The course will widen the horizon of the graduates on the theoretical basis of physical laws and principles upon which some devices operate with a view to reproduce and or modify the devices, leading to identification and development of new devices and application areas.

**Overview**

The course will brings the student into direct contact with the theories and general field applications. The knowledge will gingers the curiosity of student to direct use of physics in day to day life thereby provokes the interest of application and partnering/participation in the development of the various research and innovation. The course will bridges the gap between classwork/laboratory work and the real life applications of the physics.

**Learning Objectives**

1. Explain the significance of acoustics in our daily life
2. List the characteristics and properties of sound
3. Find the fundamental frequency present in a sound spectrum
4. Mention and explain the types of microphones
5. Find the acoustic impedance, mechanical impedance, resistive impedance, power output and efficiency of a loudspeaker
6. Differentiate between electrical reproduction of sound from a film and mechanical reproduction of sound from a disc.
7. State the assumptions required for acoustic design

**Learning outcomes**

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

1. Describe the objective and subjective assessment of sound levels
2. Differentiate between the objective and subjective of sound levels
3. Explain the significance of loudspeaker and ultrasonic generators
4. Mention the different applications of ultrasonic generators
5. Give detail explanations of microphones
6. Briefly explain reverberation time and all the equation involved in it

**Course Content**

Objective and subjective assessment of sound levels; loudness, spectrum, measurement of levels. Radiation of sound: sound fields, loudspeakers, ultrasonic generators. Applications of ultrasonic, particularly the measurement of the elastic and inelastic properties of matter. Microphones: Constructions, characteristics, calibration. Absorption of sound: measurement of acoustic impedance. Acoustics of rooms: acoustic design, measurement of reverberation time

**Minimum Academic Standards**

Physics Classes along with the NUC-MAS requirement facilities.

**4.90 BUK-PHY413: Electromagnetism and Relativity (2Units E.. LH:30)**

**Senate Approved Relevance**

To produce graduates that are equipped with advance knowledge of Electromagnetism and Relativity and its area of applications in everyday life. The graduate is expected to identify areas of exploration and employ this knowledge again, for the improvement and protection of life in line with the mission and vision of Bayero University, Kano. The course will widen the horizon of the graduates on the theoretical basis of physical laws and principles upon which some devices operate with a view to reproduce and or modify the devices, leading to identification and development of new devices and application areas.

**Overview**

The course will brings the student into direct contact with the theories of Electrostatics and magnetostatics, and general field applications. The knowledge of Laplace's equation and boundary value will gingers the curiosity of student to direct use of physics in day to day life thereby provokes the interest of application and partnering/participation in the development of the various research and innovation. The course will bridges the gap between classwork/laboratory work and the real life applications of the physics.

**Learning Objectives**

1. To explain the significance of magnetostatics in our daily life
2. To List the characteristics and properties Multiple expansions, dielectric and magnetic materials.
3. To find the fundamental frequency present in a Laplace's equation
4. To state and explain the Faraday's law.
5. To find the A.C. Circuits. Maxwell's equations
6. . To explain the Lorentz covariance and special relativity

**Learning outcomes**

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

1. Describe the objective and subjective assessment of A.C. Circuits. Maxwell's equations
2. Differentiate between various forms of the A.C. Circuits. Maxwell's equations
3. Explain the significance of loudspeaker and ultrasonic generators
4. Describe Multiple expansions, dielectric and magnetic materials.
5. Give detail explanations of microphones
6. Briefly explain special relativity

**Course Content**

Electrostatics and magnetostatics. Laplace's equation and boundary value problems; Multiple expansions, dielectric and magnetic materials. Faraday's law. A.C. Circuits. Maxwell's equations. Lorentz covariance and special relativity

**Minimum Academic Standards**

Physics Classes along with the NUC-MAS requirement facilities.

**4.10 BUK-PHY-414 Solid State Physics (2Unit E LH:30)**

**Senate Approved Relevance**

To produce graduates that are equipped with advance knowledge of Solid state Physics and their area of applications in everyday life. The graduate is expected to identify areas of exploration and employ this knowledge again, for the improvement and protection of life in line with the mission and vision of Bayero University, Kano. The course will widen the horizon of the graduates on the theoretical basis of physical laws and principles upon which some devices operate with a view to reproduce and or modify the devices, leading to identification and development of new devices and application areas.

**Overview**

The course will brings the student into direct contact with the theories of packing fraction, miller indices, and general field applications. The knowledge of Laplace's equation and boundary value will gingers the curiosity of student to direct use of physics in day to day life thereby provokes the interest of application and partnering/participation in the development of the various research and innovation. The course will bridges the gap between classwork/laboratory work and the real life applications of the physics.

**Learning Objectives**

1. To explain the significance of Solid in our daily life
2. To List the characteristics and properties Crystal and amorphous
3. To find the fundamental frequency present in a Laplace's equation
4. To state and explain the Snell's law.
5. To find the Imperfections in solids
6. To explain the Lorentz covariance and special relativity

**Learning outcomes**

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

1. Describe the paramagnetism and diamagnetics
2. Differentiate between various forms of the A.C. Circuits. Maxwell's equations
3. Explain the significance of loudspeaker and ultrasonic generators
4. Describe Multiple expansions, dielectric and magnetic materials.
5. Give detail explanations of Magnetism: paramagnetism and diamagnetics;
6. Briefly explain Dielectric properties.

**Course Content**

Dielectric properties. Magnetism: paramagnetism and diamagnetics; ferromagnetism and antiferromagnetism; magnetic resonance. Imperfections in solids.

**Minimum Academic Standards**

Physics Classes along with the NUC-MAS requirement facilities.

**4.11BUK-PHY 415: Surfaces and Interfaces (2unit E LH 30)**

**Senate Approved Relevance**

To produce graduates that are equipped with advance knowledge of surface and interface and its area of applications in everyday life. The graduate is expected to identify areas of exploration and employ this knowledge again, for the improvement and protection of life in line with the mission and vision of Bayero University, Kano. The course will widen the horizon of the graduates on the theoretical basis of physical laws and principles upon which some devices operate with a view to reproduce and or modify the devices, leading to identification and development of new devices and application areas.

**Overview**

The course will brings the student into direct contact with the theories of Twin boundary and general field applications. The knowledge of pitaxy; surface morphology and growth; will gingers the curiosity of student to direct use of physics in day to day life thereby provokes the interest of application and partnering/participation in the development of the various research and innovation. The course will bridges the gap between classwork/laboratory work and the real life applications of the physics.

**Learning Objectives**

1. To explain the Twin boundary; stacking fault; tilt and twist boundaries
2. To explain the coherent and incoherent boundaries;
3. To find the fundamental frequency present in a Laplace's equation
4. To understand the precipitates, bubbles and voids of a surface
5. To find the Imperfections in solids

**Learning outcomes**

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

1. Describe the paramagnetism and diamagnetics
2. Elaborate onRHEED,
3. Explain the significance of energy dispersive x-ray analysis,
4. Describe Multiple expansions, dielectric and magnetic materials.
5. Give detail explanations of Magnetism: photoelectron spectroscopy;
6. Briefly explain Dielectric properties.

**Course Content**

Twin boundary; stacking fault; tilt and twist boundaries; coherent and incoherent boundaries; precipitates, bubbles and voids; cracks; epitaxy; surface morphology and growth; the quartz crystal and the snowflake; surface enthalpy and entropy as distributed parameters; electric fields at surfaces; the field ion microscope; work function; contact potential; point and line defects in surfaces; adhesion and surface mobility; contamination in laboratory and interplanetary values; experimental techniques; scanning electron low energy diffraction, RHEED, energy dispersive x-ray analysis, photoelectron spectroscopy; surface modification; ion beam etching; doping of metals and semiconductors as an industrial process; cleavage under vacuum; controlled growth of heterogeneous thin films.

**Minimum Academic Standards**

Physics Classes along with the NUC-MAS requirement facilities.

**4.12BUK-PHY416: Astrophysics (2Unit E LH: 30)**

**Senate Approved Relevance**

To produce graduates that are equipped with advance knowledge of astrophysics andits area of applications in space exploration in everyday life. The verse nature of this course makes it unique and will rise the curiosity of the graduate research and development. The finds is expected to bring out innovation and business opportunities, self-reliance and SDG achievement for the improvement and protection of life in line with the mission and vision of Bayero University, Kano. The course will widen the horizon of the graduates on the theoretical basis of physical laws and principles upon which some devices operate with a view to reproduce and or modify the devices, leading to identification and development of new devices and application areas.

**Overview**

The course will brings the student into direct contact with the theories of Olbers paradox; gravitational red shift; and application to galaxy formation . The knowledge of the Pound-Rebka experiment; and the Schwarschild radius; will gingers the curiosity of student to direct use of physics in day to day life thereby provokes the interest of application and partnering/participation in the development of the various research and innovation. The course will bridges the gap between classwork/laboratory work and the real life applications of the physics.

**Learning Objectives**

1. To explain the virialtheorm;
2. To explain the application to galaxy formation;
3. To find the he limits to its application;
4. To understand the equations of hydrostatic support
5. To understand radiation pressure; energy transport

**Learning outcomes**

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

1. Describe the radiation pressure; energy transport
2. Elaborate on limitations to its application;
3. Explain the significance of energy dispersive x-ray analysis,
4. Describe virialtheorm.
5. Give detail explanations of the equations of hydrostatic support;
6. Briefly explain Space exploration

**Course Content**

Olbers paradox; gravitational red shift; the Pound-Rebka experiment; the Schwarschild radius, and examples; the virialtheorm; its application to galaxy formation, the limits to its application; centre temperature of sun; the states of stellar matter; energy sources and the virial theorem; equations of hydrostatic support; gas and radiation pressure; energy transport and opacity; transparency to neutrinos; nuclear energy; the p-p chain and the CNO cycle; the p-p one chain as a weak interaction of small cross section; solar neutrinos and current hypotheses; oxygen and silicon; burning: photo-disintegration and dynamic equilibrium; electron absorption as a catastrophic process; age of solar system and uranium isotope half-lives; electron and neutron degeneracy pressure; white dwarfs; neutron stars and black holes; the Herzsprubg-Russel diagram; stellar populations and star types; variable stars and distance measurement; other methods of distance synoptic; view of radio and x-ray Astronomy; galactic systems; the solar planetary system; the solar cemetery system.

**Minimum Academic Standards**

Physics Classes along with the NUC-MAS requirement facilities.

**4.13BUK-PHY-420: Semiconductor Devices (2Unit E LH: 30 )**

To graduate students that are introduced to semiconductor devicesadequately equipped with relevant circuit laws to analyse simple electric circuits. Relevance is seen in synthesizing electric circuits for the technological improvement of life to fulfil the mission and vision of Bayero University, Kano.

**Overview**

The course provides an introduction to alternating and direct current based electric circuits. It also provides an introduction to semiconductors necessary for understanding electronics.

**Learning Objectives:** The objectives of the course are to;

1. provide basis for understanding Effective mass; electrons and holes;
2. provide basis for understandingintrinsic and extrinsic semiconductors.
3. provide techniques for doping methods;
4. provide basis for determining drift current and mobility.
5. provide basis understanding bulk effects: resistance, thermoelectricity
6. provide basis for solving problems related to Gunn effect diode

**Learning Outcomes**

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

1. identifyJUGFET;

2. determine current flows, potential drops, power, and energy dissipation in chotiky-barrier gate;

3. simplify series and parallel combinations of resistors;

4. explainphotoconductivity;

5. apply potential divider and current divider techniques in calculating circuit potential differences and branch currents;

6. Explain interfaces; the MOSFET;

7. apply the Mesh currents and Node – Voltage methods in network analysis;

8. discuss the nature of ac. currents and voltages in resistors, inductors, capacitors and determine impedances;

9. analysea.c. circuits using phasor diagrams;

**Course Content**

Effective mass; electrons and holes; intrinsic and extrinsic semiconductors; doping methods; drift current and mobility; recombination; bulk effects: resistance, thermoelectricity, Hall effect, piezo-resistance, photoconductivity, the semiconductor plasma the Gunn effect diode; P-N junctions; solar cells; particle detectors; light emitting diodes; lasers; IMP ATT diodes; junction transistors; thyristors; the JUGFET, interfaces; the MOSFET; charge-coupled devices; memories; schotiky-barrier gate FET; hetero-junctions; integrated circuits.

**Minimum Academic Standards**

Physics Classes along with the NUC-MAS requirement facilities.

**4.14BUK-PHY-405: Introduction to Astrophysics and Cosmology (2 Units C: LH 30)**

**Senate Approved Relevance**

To produce graduates that are equipped with knowledge of Astrophysics and Cosmology in everyday life who are expected to develop capacity of questioning and rational thinking that will provide answers to societal challenges through the conduct of pivotal researches for the improvement and protection of life in line with the mission and vision of Bayero University, Kano. The course will widen the horizon of the graduates on the theoretical basis of physical laws and principles upon which some devices operate with a view to reproduce and or modify the devices, leading to identification and development of new devices and application areas.

**Course Overview**

The course gives introductory discussion to the nature, composition, dynamical behaviors and observable physical properties of the Light. It also creates a utilitarian discussion on the physics principles as used in characterizing the principle of light waves. Highlights will be given on the linkages between the various features and the physics principles as exploited in understanding the internal as well as surface manifested properties of the Fiber Optic Communications and Non-Communication. It covers introductory on such features as Thus course will provide insight on the general picture on how and why scientists have broad understanding of the wave by the use of physics principles as well as some observable mysteries.

**Learning Objectives:** The objectives of the course are to;

1. provide the composition and structure of the atmosphere;
2. provide basis for solving complex resistor networks.
3. provide explanation on magnetosphere and its boundaries and interactions with plasma
4. provide basis for determining the sun’s radiation and principles of radiative heat transfer
5. describe the sources and nature of atmospheric turbulence
6. provide basis for understandingatmospheric electricity via thunderstorm and the fair-weather condition

**Learning Outcomes**

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

1. explain the composition and structure of the atmosphere;
2. explain the magnetosphere and its boundaries and interactions with plasma;
3. state the nature of the sun’s radiation and principles of radiative heat transfer;
4. describe the sources and nature of atmospheric turbulence;
5. apply the concept of charge production, transport, and loss in the atmosphere; and
6. explain the transport of atmospheric electricity via thunderstorm and the fair-weather condition.

**Course Contents**

The Universe and its physics (A tour of the Universe, its scale and contents, gravity, pressure and radiation). The age of the universe. Evolution of the universe. Evidence for the Big Bang theory. Observational astronomy. The electromagnetic spectrum. Geometrical optics. Resolving power and the diffraction limit. Telescopes and detectors. Gravitational waves. Astronomical distances. Parallax measurements. Standard candles. Physics of the sun and stars. Blackbody radiation. Stefan-Boltzmann and Wien laws. Effective temperature. Interstellar reddening. Hydrogen spectral lines and Doppler effect. Hertzprung-Russell diagram. Freefall and Kelvin-Helmholtz time. Nuclear fission and fusion. Basic stellar structure (hydrostatic equilibrium, equation of state). White dwarfs. Neutron stars and black holes. Planetary systems. Kepler's laws. Detection methods of extrasolar planets. Search for life elsewhere. SETI. Galaxies. Star formation and the interstellar medium. Stellar populations. Galaxy rotation curves. Mass and dark matter. Galaxy collisions. Cosmology: Olber’s paradox. Hubble's Law. Dark energy and the accelerating Universe.

**Minimum Academic Standards**

Physics Classes along with the NUC-MAS requirement facilities.

**4.15BUK-PHY-409: Dynamic Meteorology**  **(3 Units C: LH 45)**

**Senate Approved Relevance**

To produce graduates that are equipped with knowledge of Dynamic Meteorology in everyday life who are expected to develop capacity of questioning and rational thinking that will provide answers to societal challenges through the conduct of pivotal researches for the improvement and protection of life in line with the mission and vision of Bayero University, Kano. The course will widen the horizon of the graduates on the theoretical basis of physical laws and principles upon which some devices operate with a view to reproduce and or modify the devices, leading to identification and development of new devices and application areas.

**Course Overview**

The course gives introductory discussion to the physical laws governing atmospheric motion. It also creates a utilitarian discussion on Forces acting on a fluid element. Highlights will be given on the linkages between the various features and the physics principles as exploited in understanding the internal as well as Effect of the shape of the earth on the equations. It covers introductory on such features as Thus course will provide insight on the general picture on how and why scientists have broad understanding of the wave by the use of physics principles as well as some observable mysteries.

**Objectives:** The objectives of the course are to;

1. provide basis for understanding equations of motion of a non-inertia (rotating) frame of reference;
2. provide basis for solving thermal wind equations-Barotropic and Baroclinic atmospheres.
3. provide techniques for solving thermal wind and advection
4. provide basis for determining simple pressure tendency equation.
5. provide basis for solving ac and dc circuits
6. provide knowledge on Importance and application to development or otherwise of lows and highs

**Learning Outcomes**

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

1. explain the physical laws governing the atmospheric motion;
2. explain the concepts of Instability mechanism: atmospheric disturbances as consequences of instability.
3. Understand the pseudo vertical velocity (w) in pressure co-ordinates
4. explain the equations of motion in other co-ordinates (e.g. pressure) and their advantages
5. explain the thermal wind equations-Barotropic and Baroclinic atmospheres

**Course Contents**

The physical laws governing atmospheric motion. Forces acting on a fluid element.

Equations of motion of a non-inertia (rotating) frame of reference. Effect of the shape of the earth on the equations. Scale analysis of the full equations leading to the hydrostatic, geostrophic approximations. The continuity equation. The thermal wind equations-Barotropic and Baroclinic atmospheres. Thermal wind and jet streams. Thermal wind and advection. Circulation and vorticity. Application to land and sea breezes. Divergence and convergence. Derivations and discussion of the vorticity equation; middle latitude and tropical cases. The equations of motion in other co-ordinates (e.g. pressure) and their advantages. The primitive equations. The pseudo vertical velocity (w) in pressure co-ordinates. The simple pressure tendency equation. Importance and application to development or otherwise of lows and highs. Instability mechanism: atmospheric disturbances as consequences of instability. Treatment of barotropic and baroclinic instabilities; convective instability and conditional instability of the second kind (CISK). Atmospheric wave motions.

**Minimum Academic Standards**

Physics Classes along with the NUC-MAS requirement facilities.

**4.16BUK-PHY-402 Plasmas (3 Unit LH 45)**

**Senate Approved Relevance**

To produce graduates that are equipped with knowledge of Plasma in everyday life who are expected to develop capacity of questioning and rational thinking that will provide answers to societal challenges through the conduct of pivotal researches for the improvement and protection of life in line with the mission and vision of Bayero University, Kano. The course will widen the horizon of the graduates on the theoretical basis of physical laws and principles upon which some devices operate with a view to reproduce and or modify the devices, leading to identification and development of new devices and application areas.

**Course Overview**

One of the state of matter is Plasma. Its unique futures and significance cannot be over emphasis. The course gives introductory discussion to the change in state from Gas to Plasma. It futher explain electron oscillation, MHD equations, pinxh and it stabilization. The characteristic of Magnetic mirror and method of heating plasma was explained. Propagation, diffusion and conduction of wave in plasma was elaborated. It covers introductory on such features as Thus course will provide insight on the general picture on how and why scientists have broad understanding Plasma by the use of physics principles as well as some observable mysteries.

**Learning Objectives:** The objectives of the course are to;

1. provide basis for understanding change in state from Gas to Plasma
2. provide basis for solving MDH equations.
3. provide techniques for propagation of wave in plasma
4. provide basis for explainingplasmas in space.
5. provide basis for discussing in metals and in semiconductors
6. provide knowledge on Importance and application to development or otherwise;

**Learning Outcomes**

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

1. explain the physical laws governing the plasma transition (Gas to Plasma)
2. explain plasmas in space
3. Understand metals and semiconductors in relations to Plasma
4. explain the equations of propagation of wave in plasma
5. explain MDH equations

**Course Contents**

From gas to plasma; electron oscillation; MHD equations; the pinch and its stabilization. Magnetic mirror; methods of heating a plasma; propagation of waves in plasmas; diffusion and conduction; plasmas in space, in fusion devices, in metals and in semiconductors.

**Minimum Academic Standards**

Physics Classes along with the NUC-MAS requirement facilities.

**4.17BUK-PHY-417Gases (3 Unit LH 45)**

**Senate Approved Relevance**

To produce graduates that are equipped with knowledge of Gas in everyday life who are expected to develop capacity of questioning and rational thinking that will provide answers to societal challenges through the conduct of pivotal researches for the improvement and protection of life in line with the mission and vision of Bayero University, Kano. The course will widen the horizon of the graduates on the theoretical basis of physical laws and principles upon which some devices operate with a view to reproduce and or modify the devices, leading to identification and development of new devices and application areas.

**Course Overview**

The course gives introductory discussion to Molecular dimensions; mean free path. It also elaborate on types of gas molecules; active and inactive; enthalpy of association; the free energy of active gasesthe physics principles as used in explain gas with respect to monatomic and polyatomic molecules; rotation and vibration; specific heats. The intermolecular potential of inactive gas molecules; cross section; critical temperature and latent heat of condensation. Further morethe Boltzmann distribution and its assumption; the Maxwell velocity and speed distributions, will be exhaustively discussed.

**Learning Objectives:** The objectives of the course are to;

1. provide basis for understanding change in state from Liquid to Gas
2. provide basis for usingequipartition theorem.
3. provide techniques for Doppler width observations; diffusion
4. provide basis for explaining Knudsen gases, van der Waals and formulation of kinetic theory.
5. provide basis for fluctuations in density and scattering of light.
6. provide knowledge on Importance and application to development or otherwise;

**Learning Objectives**

**Learning Outcomes**

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

1. explain the physical laws governing the plasma transition (Liquid to Gas)
2. explainequipartition theorem.
3. Understand metals and semiconductors in relations to Gas
4. explain the Doppler width observations; diffusion
5. explain fluctuations in density and scattering of light

**Course Contents**

Molecular dimensions; mean free path; types of gas molecules; active and inactive; enthalpy of association; the free energy of active gases; monatomic and polyatomic molecules; rotation and vibration; specific heats; the intermolecular potential of inactive gas molecules; cross section; critical temperature and latent heat of condensation; the Boltzmann distribution and its assumption; the Maxwell velocity and speed distributions. The equipartition theorem, its approximate application to gases and its rigorous application; experimental differences between the two. Mixing in a flow of heat, temperature difference induced by concentration gradient. Doppler width observations; diffusion. Viscosity, thermal conductivity; effusion. Knudsen gases, van der Waals and formulation of kinetic theory, fluctuations in density and scattering of light.

**Minimum Academic Standards**

Physics Classes along with the NUC-MAS requirement facilities.

**4.18BUK-PHY-418Liquids (3Unit LH 45)**

**Senate Approved Relevance**

To produce graduates that are equipped with knowledge of Liquid in everyday life who are expected to develop capacity of questioning and rational thinking that will provide answers to societal challenges through the conduct of pivotal researches for the improvement and protection of life in line with the mission and vision of Bayero University, Kano. The course will widen the horizon of the graduates on the theoretical basis of physical laws and principles upon which some devices operate with a view to reproduce and or modify the devices, leading to identification and development of new devices and application areas.

**Course Overview**

The course gives Liquids as dense gases and as distordered solids. It also elaborate on Newtonian and Bingham liquids; liquids plymers; superheating estimated; the Einstein short range order; the miscibility of liquids; solution of gases and solids in a liquid. The crysitallisaion and melting the glassy state; polymers; liquid crystals. Further moretheliquid crystals; soap and lipids; suspensions and colloidal solutions; structure of water will be exhaustively discussed.

**Learning Objectives:** The objectives of the course are to;

1. provide basis for understanding change in state from Solid to Liquid
2. provide basis for applying Einstein short range order
3. provide ways for solving the problems in gases and solids in a liquid
4. provide basis for explaining Newtonian and Bingham liquids
5. provide basis for fluctuations in density and scattering of light.
6. provide knowledge on suspensions and colloidal solutions; structure of water.;

**Learning Outcomes**

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

1. explain the physical laws governing the plasma transition (Solid to Liquid)
2. explainNewtonian and Bingham liquids.
3. Understand metals and semiconductors in relations to Liquid
4. explain the in gases and solids in a liquid
5. explain suspensions and colloidal solutions; structure of water

**Course Contents**

Liquids as dense gases and as distordered solids; tensile strength of a liquid; cohesion and surface tension; shear strength, Newtonian and Bingham liquids; liquids plymers; superheating estimated form van der Waals equation; pour pressure of a liquid; diffusion, viscosity and Einstein short range order; the miscibility of liquids; solution of gases and solids in a liquid; ionic solutions and the flow of electricity; crysitallisaion and melting the glassy state; polymers; liquid crystals; soap and lipids; suspensions and colloidal solutions; structure of water.

**Minimum Academic Standards**

Physics Classes along with the NUC-MAS requirement facilities.

**4.19BUK-PHY-419Solids (3Unit LH 45)**

**Senate Approved Relevance**

To produce graduates that are equipped with advance knowledge of Solid and their area of applications in everyday life. The graduate is expected to identify areas of exploration and employ this knowledge again, for the improvement and protection of life in line with the mission and vision of Bayero University, Kano. The course will widen the horizon of the graduates on the theoretical basis of physical laws and principles upon which some devices operate with a view to reproduce and or modify the devices, leading to identification and development of new devices and application areas.

**Overview**

The course will brings the student into direct contact with the theories of packing fraction, miller indices, and general field applications. The knowledge of Laplace's equation and boundary value will gingers the curiosity of student to direct use of physics in day to day life thereby provokes the interest of application and partnering/participation in the development of the various research and innovation. The course will bridges the gap between classwork/laboratory work and the real life applications of the physics.

**Objectives**

1. To explain the significance of Solid in our daily life
2. To List the characteristics and properties Crystal and amorphous
3. To find the fundamental frequency present in a Laplace's equation
4. To state and explain the Snell's law.
5. To Explain dieclectric properties;
6. To explainferroelectrics; optical properties and free carriers.

**Learning outcomes**

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

1. Describe the Solid
2. Differentiate between Crystal and amorphous
3. Explain the significance of Laplace's equation in solid
4. Describe Snell's law.
5. Give detail explanations of Magnetism: paramagnetism and diamagnetics;
6. Briefly explain ferroelectrics; optical properties.

**Course Contents**

Structure of amorphous condition for monocrysallinity; natural and man-made amorphous solids; silicon and selenium and their applications; metastabilty I amorphous solids; the growth of crystals; crystalline order and line defects; points defects and melting; ductile and brittle solids; mechanisms of deformations ; crystallography; unit cell, lattice planes and rows; x-ray and electron diffraction; reciprocal lattice; the Nye bubble rafts, ionic, molecular, covalent and metallic bonding examples; mixed bonding in graphite; one and two dimensional anisotropy relation between crystal structure and useful properties; melting point, hardness, optical and electrical properties; lattice vibrations and heat capacity, classical and quantum one and three dimensions; thermal expansion and conductiviry of insulators; second sound mobile electrons in semiconductors; acceptors; Hall effect and cyclotron resonance; metals ; the free electron model; heat capacity and conductivity; periodic potential and effective mass; Brillouin zones and Fermi surfaces; plasma oscillations; para-ida. Ferra and antiferomagnetism; magnetic order; superconductivity; the Josephson junction and quantum interferometers; dieclectric properties; ferroelectrics; optical properties and free carriers.

**Minimum Academic Standards**

Physics Classes along with the NUC-MAS requirement facilities.

**4.20BUK-PHY 421: Forensic Physics (2 Units C: LH 30)**

**Course Overview**

The course gives introductory discussion to the nature, composition, dynamical behaviors and observable physical properties matter. It also creates a utilitarian discussion on the physics principles as used in investigation. Highlights will be given on the linkages between the various features and the physics principles as exploited in understanding the optics manifested properties of the Propagation of sound and standing. It covers introductory on such features as Thus course will provide insight on the general picture on how and why scientists have broad understanding of the wave by the use of physics principles as well as some observable mysteries.

**Objectives:** The objectives of the course are to;

1. Explain the Physics of Speech: generation of sound;
2. providephysical properties of vibrating systems..
3. provide Forensic photography
4. provide basis for determining power and energy dissipation of electric circuits.
5. provide basis for solving ac and dc circuits
6. provide Methods for developing photographs:

**Learning Outcomes**

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

1. demonstrate knowledge and understanding of aspects of Physics of speech, including production of sound, amplitude vibration, sine waves, simple harmonic motion and physical properties of vibrating systems;
2. describe modes of vibration and its significance in voice identification;
3. learn the causes and investigation of vehicular accidents;
4. demonstrate knowledge and understanding of aspects of automobile accidents, including sources of information, eye witnesses’ accounts, tire and other marks, speed and damage, time and distance, reaction time, pedestrian impacts and vehicle condition;
5. demonstrate knowledge and understanding of elements of forensic photography such as types of cameras and films, digital photo imaging, Exposure Index, ISO number, photo imaging evidence, surveillance photography, aerial photography and methods for developing photographs; and,
6. describe legal aspects of visual evidence, photography of fingerprints, impressions and tool marks.

**Course Contents**

Physics of Speech: generation of sound, amplitude vibration, simple harmonic motion, sine waves, physical properties of vibrating systems. Propagation of sound and standing waves, modes of vibration and its significance in voice identification. Causes and investigation of vehicular accidents: automobile accidents-introduction, sources of information, eyewitnesses, tire and other marks, pedestrian impacts and vehicle condition, speed and damage. Curved scuffmarks, time and distance, reaction time. Photography and plans. Forensic photography: introduction, types of cameras and films, digital photo imaging, ISO number, exposure index, photo imaging evidence. Angle, scale, depth of field, light, ambient light, colour, temperature, flash/ strobe. Surveillance photography and aerial photography and accessories. Methods for developing photographs: highspeed photography, legal aspects of visual evidence; image magnification, photography of fingerprints, impressions, tool marks and restored latent prints and impressions.

**Minimum Academic Standards**

Physics Classes along with the NUC-MAS requirement facilities.

**4.21BUK-PHY-403: PHYSICS OF THE EARTH ( 2Units C, 30 LH)**

**Senate Approved Relevance**

To produce graduates that are equipped with knowledge of Physics in everyday life who are expected to develop capacity of questioning and rational thinking that will provide answers to societal challenges through the conduct of pivotal researches for the improvement and protection of life in line with the mission and vision of Bayero University, Kano. The course will widen the horizon of the graduates on the theoretical basis of physical laws and principles upon which some devices operate with a view to reproduce and or modify the devices, leading to identification and development of new devices and application areas.

**Course Overview**

The course gives introductory discussion to the nature, composition, dynamical behaviors and observable physical properties of the earth. It also creates a utilitarian discussion on the physics principles as used in characterizing the earth as an entity. Highlights will be given on the linkages between the various features and the physics principles as exploited in understanding the internal as well as surface manifested properties of the earth. It covers introductory on such features as shape, layering, nature and composition of layers, thermal distribution, dating, plates gyration, ocean distribution and geomagnetism of the earth. Thus course will provide insight on the general picture on how and why scientists have broad understanding of the earth by the use of physics principles as well as some observable mysteries.

**Learning Objectives**

The objectives of the course are as follows:

1. To give overview on the general dynamical features of the Light,
2. To provide introductory discussion on the structure and composition Geometric Optics,
3. To highlight the basic principles of physics as used in the study of the Light waves
4. To demonstrate how plausible arguments in conjunction with physics principles are exploited in developing concepts for characterizing the constitution and observed behaviors of the principle of light waves .
5. To provide a good framework for generating a vivid picture and explanation for present and future behaviors of the Laser.

**Learning Outcomes**

The learning Outcomes of the study are as follows:

1. Student should identify and understand the basic principles used in characterizing the Light
2. Student will be able to proper explanation on observable behaviors of the Geometric Optics
3. Demonstrate with good understanding of the Applications, Prisms and Thin Lenses, Aberration Theory.
4. Show good understanding on the terminologies as used in the study of theprinciple of waves optics, and
5. Student will have gotten a springboard for soft landing and be well informed in the course of decision making and career advancement.
6. Explain Fiber Optic Communications and Non-Communication

**Course Contents**

Shape, mass and moment of inertia; origin and explosion composition; the continental crust; earthquake and explosion seismology; structure and origin of the crust; gravitational anomalies; continental drift, oceanic crustal structure; sea floor spreading and ridges, magnetic anomalies, plate tectonics; seismology of the mantle and core; temperature and composition of the mantle; structure, composition and temperature of the core, origin and secular variation of the geomagnetic fields; internal sources of heat; heat flow through lithosphere and crust; geology of crust and mantle.

**Minimum Academic Standards**

Physics Classes along with the NUC-MAS requirement facilities.

**4.22BUK-PHY-422: Introduction to Photonics** (3Units E LH: 45 PH:45)

**Senate Approved Relevance**

To produce graduates that are equipped with knowledge of Photonics in everyday life who are expected to develop capacity of questioning and rational thinking that will provide answers to societal challenges through the conduct of pivotal researches for the improvement and protection of life in line with the mission and vision of Bayero University, Kano. The course will widen the horizon of the graduates on the theoretical basis of physical laws and principles upon which some devices operate with a view to reproduce and or modify the devices, leading to identification and development of new devices and application areas.

**Course Overview**

The course gives introductory discussion to the nature, composition, dynamical behaviors and observable physical properties of the Light. It also creates a utilitarian discussion on the physics principles as used in characterizing the principle of light waves. Highlights will be given on the linkages between the various features and the physics principles as exploited in understanding the internal as well as surface manifested properties of the Fiber Optic Communications and Non-Communication. It covers introductory on such features as Thus course will provide insight on the general picture on how and why scientists have broad understanding of the wave by the use of physics principles as well as some observable mysteries.

**Learning Objectives**

The objectives of the course are as follows:

1. To give overview on the general dynamical features of the earth,
2. To provide introductory discussion on the structure and composition of the earth,
3. To highlight the basic principles of physics as used in the study of the earth
4. To demonstrate how plausible arguments in conjunction with physics principles are exploited in developing concepts for characterizing the constitution and observed behaviors of the earth.
5. To provide a good framework for generating a vivid picture and explanation for present and future behaviors of the earth.

**Course Content**

Introduction to Photonics, Introduction to Light,. Light Sources,. Geometrical Optics,. Light as a Ray, Law of Reflection including Plane Mirrors, Law of Refraction including Optical Fiber Applications, Prisms and Thin Lenses, Aberration Theory,. Principles of wave optics Interference and Interference Applications. Diffraction and Diffraction Gratings. Polarization Principles. Interferometers Detectors P-n junctions. Rate equations. Introduction to Lasers Optical gain, Gain Saturation, Optical Detectors with Low and High Power Laser Applications in Photonics LaserSafety. Fiber Optics Optical Fiber Construction, System Components and Characteristics. Optical Fiber Types and their Properties. Optical Fiber Light Sources, Optical Sensors and Connectors. Optical Fiber Measurement and Testing Terminology. Fiber Optic Communications and Non-Communication Fundamentals and Applications. . Basics of holography with image processing. Theory and Basic Principles. Image and Optical Signal Processing with Applications in Photonics

**Minimum Academic Standards**

Physics Classes, Laboratory, and the NUC-MAS requirement facilities.