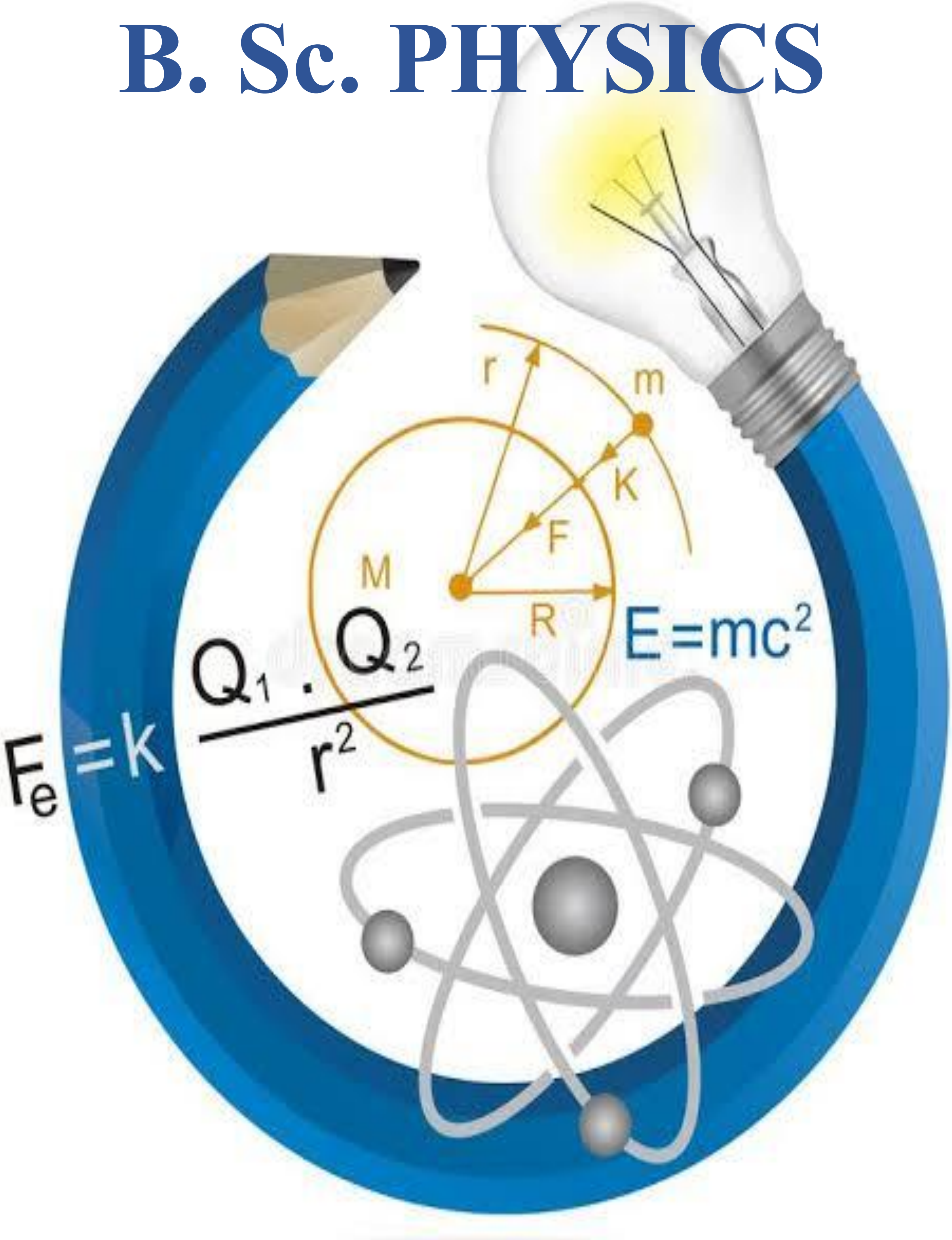
BINGHAM UNIVERSITY, KARU

B. Sc. PHYSICS



STUDENT HANDBOOK

2023-2028

Preface

This handbook is a necessary reference material for all stakeholders - students and academic staff; giving details on the choice of courses and requirements for the successful conduct of academic activities in the Department of Physics. It guides all staff and students towards achieving a high-quality education aimed at producing Physicists knowledgeable in analytical and critical reasoning skills necessary to understand scientific concepts and solve problems across disciplines.

This handbook introduces all the courses offered in the department, basic admission requirements, procedures for project presentations and guidance for the writing and submission of project reports.

It does not supplant the Bingham Student handbook or any of the rules and regulations guiding undergraduate programmes in the University. It is a complementary guide that highlights some of the peculiarities of the Physics programme.

Dr Omolara Victoria Oyelade, ***NIP, MRS***
Head of Department

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Staff of the Department

S/No	NAME	QUALIFICATION	RANK	STATUS	FIELD OF SPECIALIZATION
1.	Prof. Hycienth Aboh	B. Sc. (Hons), M.Sc., Ph.D.	Professor (Visiting)	Visiting	Applied Geophysics
2.	Prof. Nestor Chagok	B. Sc. (Hons), PDE, M.Sc., Ph.D.	Professor (Visiting)	Visiting	Electrodynamics & Acoustics/Ultrasonics
3.	Asso. Prof. Michael Adeleye	B. Sc. (Hons), PGDE, M.Sc., Ph.D.	Associate Professor	Full-time	Nuclear Physics
4.	Asso. Prof. Folake Joseph	B.Sc., M.Sc., Ph.D.	Associate Professor	Adjunct	Optimization & Numerical Analysis
5.	Dr. Ageebee Silas Faki	M.Sc., Ph.D.	Senior Lecturer	Adjunct	Software Development & Algorithm
6.	Dr. Ochai Oklobia	B.Sc., M.Sc., Ph.D.	Lecturer I	Postdoc	Electrical/Electronics
7.	Mr. Emmanuel Paul Amade	B.Sc., M.Sc.	Lecturer I	Full-time	Geophysics
8.	Dr. Omolara Victoria Oyelade	B.Sc., M.Sc., Ph.D.	Senior Lecturer	Full-time	Electronics/Solar Energy
9.	Mrs. Victoria Taye Oluwasusi	B.Sc., M.Sc.	Lecturer II	Full-time	Materials Science/Solid State Physics
10.	Mr. Emmanuel Echioda	HND (Physics with Electronics)	Principal Technologist	Full-time	Physics Electronics
11.	Mr. Theophilus Danjuma Toro	HND, PGD (Edu), PGD (Physics), M.Sc. Physics	Senior Technologist	Full-time	Geophysics

Contents

B. SC. PHYSICS

Introduction

Physics form the basis of study upon which other branches of science are founded. Physics is concerned with the fundamental behaviour of matter and energy. Bingham's undergraduate physics curricular provide future scientists with a strong background in the classical area of physics as well as an introduction to modern physics. A degree in physics can open a number of lucrative and rewarding fields with careers in academia as well as the public and private sectors.

Mission of the University
To produce graduates that have both knowledge and skills for self-reliance in the fear of Christ.

Philosophy of the University
Bingham University envisages a distinctly Christian Academic Community in which people are transformed and equipped with secular education with Christ-like thinking.

Objectives of the University
Bingham University seeks to provide secular higher education in a Christ centred educational environment that clearly promotes excellence and character development for service to God, His Church and the society at large.

Overview

The B.Sc. Physics degree program is design to provide basic foundation of Physics in the first and second year through courses covering classical physics, electricity and magnetism, waves and optics, dynamics, thermodynamics, modern physics, computer literacy, and special theory of relativity, as well as underlining mathematical concepts that underpin a better understanding of the courses. The scope of energy and environment as well as weather and space science had been widened in line with the global concern on sustainable development. A new course on workshop practice had been introduced to provide the students with a flavour of engineering design and electronic instrumentation.

The third-year courses of the program build on the basic foundations and cover the transition between classical and quantum physics including electromagnetic waves, electromagnetism, statistical physics, and the student industrial work experience scheme design to compliment the theory learned in the classroom and practical applications and experience of the industries. The diverse topics covered as taught courses will be complimented during each year by laboratory practical's that enable the students understand and appreciate the principles, theorems, and laws in physics.

The fourth-year courses of the program are designed to provide further mathematical knowledge that buttress the applications of quantum mechanics, nuclear physics, and of special mathematical functions in physics. A range of diverse modern courses have been introduced to enable the students choose from various fields of specialization in physics as well as to carry out a scientific research project.

Philosophy

The Physics department aims to help each student develop the analytical and reasoning skills necessary to understand scientific concepts and apply scientific thought and the scientific method across disciplines. As future leaders on the African continent, our students are being challenged to analyse and solve complex problems in order to become global problem solvers. We believe that the analytical and reasoning skills students acquire through the study of experimental sciences provide a strong foundation for understanding larger scale problems and identifying and testing possible solutions.

Aim of the Programme

The Physics programme aims at producing competent intellectuals with the ability to apply knowledge and skills to solving theoretical and practical problems in science and industry, for national development and meeting societal needs of the 21st century and beyond. The programme aims to produce Physicists who will make technological advances of modern products that make lives safer, better and easier as well as improving the security and infrastructure of our Nation and apply the knowledge of Physics to electronics and telecommunications, mineral exploration for diversification of the economy.

Objectives

The Bachelor of Science (B.Sc.) programme in Physics is therefore geared towards providing the undergraduate the opportunity to develop:

1. a sense of enthusiasm for Physics discipline and appreciation of its applications in industrial, economic, technological and social contexts;
2. analytical skills, competence and critical thinking in the application of scientific methods to seek solutions to problems;
3. the spirit of enquiry, creativity and self-reliance in the practice of Physics;
4. the right applications of the theories, concepts and principles of Physics in solving societal problems and adaptability to the changing situation of the modern world.
5. interest in and commitment to the Physics discipline as imperative for national development; and
6. provide students with a knowledge and skills base for further studies in Physics or multidisciplinary areas involving physics.

Unique Features of the Programme

The blend of courses in this revised curriculum are meant to provide:

1. topics that cover modern areas of research and developments in physics in tune with best practices of globally top-rated universities;
2. course structures that are also designed in such a way to prepare the students towards multidisciplinary advanced studies.;
3. a course on workshop practices which is intended to expose the students to instrumentation and engineering design that will enable them produce simple instruments for either training and or research; and

4. a course on entrepreneurship for physicist which is also intended to provide the students with the required skills for innovation and job creation.
5. Laboratory training in the handling, analyses and evaluation of new technology.
6. Computer applications

Employability Skills

The range of courses to be covered in the program are intended to prepare and equip the students with the necessary and relevant theoretical knowledge and practical skills that are required of a physicist in;

1. Foresight
2. Resourcefulness
3. Planning
4. Organization
5. Time management
6. Design and execution of local and global challenges with solutions that are multidimensional and with professionalism.

21st Century Skills

1. Creativity
2. Communication and IT
3. Design and Construction
4. Planning and Experimentation
5. Innovation and Entrepreneurship

Admission and Graduation Requirements

Duration of study

The minimum duration of the programme is four years and maximum duration is six years. The minimum recommended duration of the first degree is eight (8) academic semesters. The first-degree programme leads to the award of a Bachelor's degree in Physics. A students' Industrial Training (SIWES) programme of three months duration shall be incorporated in the programme without prejudice to the minimum academic semesters recommended above.

Admission Requirements

Admission into the Physics programme may be through any of the following modes:

(a) UTME

1. Minimum of five (5) O'level credit passes to include English Language, Mathematics, Physics, Chemistry, Biology or Agricultural Science or Geography at the Senior Secondary School Certificate or its equivalent.
2. UME subjects - Use of English, Physics, Mathematics, and Chemistry or Biology.
3. Students must score minimum points as approved by JAMB for the session.
4. Acceptable performance at the University's post – UME screening exercise.

(b) Direct Entry (DE)

1. Holders of GCE A'level/IJMB passes in at least two relevant science subjects (Biology, Chemistry, Physics, and Mathematics or Geography) may be admitted into 200 level.
2. ND Holders with minimum of Upper Credit in relevant discipline may be admitted into 200 level.
3. NCE Holders with two credit passes in relevant discipline may be admitted into 200 level.
4. Holders of HND with Lower Credit in relevant discipline may be admitted into 200 level. Holders of HND with Upper Credit or Distinction in relevant discipline may be admitted into 300 Level.

Transfer

Students who have satisfied the O'level requirements and have a minimum CGPA of 2.40 in a Department of Physics from any certified University in Nigeria or abroad is eligible for a transfer into 200 level.

Graduation Requirements

Total minimum credit units required for graduation is 120 and 90 or 60 for students admitted through UTME and Direct Entry admissions respectively. In order to graduate, a student must pass all compulsory and required courses. The minimum credit requirements for Direct Entry students' eligibility for graduation are to be determined by their entry level.

To be eligible for award of the B.Sc. Physics, a candidate must have satisfied the following conditions:

1. The normal university requirement.
2. The approved requirement of the Faculty of Sciences including general studies, with respect to approved curriculum and registered courses (compulsory and approved electives) through the duration of the programme.
3. A candidate must have satisfactorily completed Industrial Attachment of not less than three months in a relevant area. Instruction is by lectures, practical, field work and course evaluations.
4. Total Minimum Credit Unit Required for Graduation= 120
5. Total Minimum Credit Unit Required per Semester = 15
6. Elective Minimum Credit Unit Required for Graduation = 10

Course Content and Synopsis for Bachelor of Science (B. Sc.) Physics Programme

The following table depicts the course structure and synopsis for the levels and semesters of the B.Sc. Physics Programme. The abbreviations used in the table are explained as follows:

i.	LH	Lecture hours
ii.	PH	Practical hours
iii.	Units	Credit units
iv.	C	Core course
v.	E	Elective course

vi. GST General studies course
vii. MTH Mathematics course
viii. PHY Physics course
ix. ENT Entrepreneurship course
x. BHU-PHY Bingham University Physics Course
xi. BHU-BST Bingham University Bible Study Course
xii. BHU-LEM Bingham University Leadership Course

Global Course Structure

100 Level

Course code	Course title	Units	Status	LH	PH
GST 111	Communication in English	2	C	15	45
GST 112	Nigerian People and Culture	2	C	30	-
COS 101	Introduction to Computer Science	3	C	30	45
MTH 101	Elementary Mathematics I	2	C	30	-
MTH 102	Elementary Mathematics II	2	C	30	-
PHY 101	General Physics I	2	C	30	-
PHY 102	General Physics II	2	C	30	-
PHY 103	General Physics III	2	C	30	-
PHY 104	General Physics IV	2	C	30	-
PHY 107	General Physics Practical I	1	C	-	45
PHY 108	General Physics Practical II	1	C	-	45
BHU-PHY 109	Science of Materials	2	C	30	-
BHU-PHY 110	Scientific Equipment and Procurement	1	C	15	-
BHU-PHY 111	General Chemistry I	2	C	30	-
BHU-PHY 112	Biophysics I	2	C	30	-
BHU-BST 104	Christian Belief	2	E	30	-
Total		**30**			

200 Level

Course code	Course title	Units	Status	LH	PH
GST 212	Philosophy, Logic and Human Existence	2	C	30	-
ENT 211	Entrepreneurship and Innovation	2	C	15	45
PHY 201	General Physics V (Modern Physics)	2	C	30	-
PHY 202	Introduction to Electric Circuits and Electronics	2	C	30	-

PHY 204	General Physics VI (Waves and Optics)	2	C	30	-
PHY 205	Thermal Physics	2	C	30	-
PHY 206	General Physics VII (Energy and Environment)	2	C	30	-
PHY 207	General Physics Practical III	1	C	-	45
PHY 208	General Physics Practical IV	1	C	-	45
PHY 211	Workshop Practice	2	C	15	45
BHU-PHY 209	Classical Physics I	2	C	30	-
BHU-PHY 210	Classical Physics II	2	C	30	-
BHU-PHY 213	Solid State Physics I	2	C	30	-
BHU-PHY 215	Computer Programming I	3	C	30	45
BHU-BST 203	Christian World View I	1	E	15	-
BHU-BST 204	Christian World View II	1	E	15	-
BHU-LEM 210	Leadership and Mentorship	1	E	15	-
Total		**30**			

300 Level

Course code	Course title	Units	Status	LH	PH
GST 312	Peace and Conflict Resolution	2	C	30	-
ENT 312	Venture Creation	2	C	15	45
PHY 301	Analytical Mechanics I	2	C	30	-
PHY 303	Electromagnetism	3	C	45	-
PHY 304	Electromagnetic Waves and Optics	3	C	45	-
PHY 305	Quantum Physics	3	C	45	-
PHY 306	Statistical and Thermal Physics	2	C	30	-
PHY 307	General Physics Practical V	1	C	-	45
PHY 308	General Physics Practical V	1	C	-	45
PHY 318	Semiconductor Devices	3	C	45	-
PHY 399	Industrial Attachment (12 Weeks)	3	C		
BHU-PHY 309	Mobile Communication Systems	2	E	15	45
BHU-PHY 311	Photovoltaic Design and Installation	3	C	30	45
	Total	**30**			

400 Level

Course code	Course title	Units	Status	LH	PH
PHY 401	Quantum Mechanics I	3	C	45	-
PHY 402	Quantum Mechanics II	3	C	45	-
PHY 403	Mathematical Methods in Physics I	3	C	45	-
PHY 404	Mathematical Methods in Physics II	3	C	45	-
PHY 405	Physics Entrepreneurship	2	C	30	-
PHY 455	Research Project	6	C	-	270
BHU-PHY 406	Renewable Energy Systems and Technology	2	E	15	45
BHU-PHY 407	Electronics I	2	C	30	-
BHU-PHY 408	Introduction to Nuclear and Particle Physics	2	C	30	-
BHU-PHY 409	Research Methodology and Presentation Skills	2	C	30	-
BHU-PHY 411	Computational Physics	2	C	15	45
	Total	**30**			

Course Contents and Learning Outcomes

100 Level

GST 111: Communication in English (2 Units C: LH 15; PH 45)

Learning Outcomes

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

1. identify possible sound patterns in English Language;
2. list notable Language skills;
3. classify word formation processes;
4. construct simple and fairly complex sentences in English;
5. apply logical and critical reasoning skills for meaningful presentations;
6. demonstrate an appreciable level of the art of public speaking and listening; and
7. write simple and technical reports.

Course Contents

Sound patterns in English Language (vowels and consonants, phonetics, and phonology). English word classes (lexical and grammatical words, definitions, forms, functions, usages, collocations). Sentence in English (types: structural and functional, simple, and complex). Grammar and Usage (tense, mood, modality and concord, aspects of language use in everyday life). Logical and critical thinking and reasoning methods (logic and syllogism, inductive and deductive argument and reasoning methods, analogy, generalisation and explanations). Ethical considerations, copyright rules, and infringements. Writing activities: (pre-writing, writing, post writing, editing and proofreading; brainstorming, outlining, paragraphing). Types of writing: summary, essays, letter, curriculum vitae, report writing, note making etc. Mechanics of writing. Comprehension

Strategies: (reading and types of reading, comprehension skills, 3RsQ). Information and Communication Technology in modern Language Learning. Language skills for effective communication. Major word formation processes. Writing and reading comprehension strategies. Logical and critical reasoning for meaningful presentations. Art of public speaking and listening. Report writing.

GST 112: Nigerian peoples and culture (2 Units C: LH 30)

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

1. analyse the historical foundation of the Nigerian culture and arts in pre-colonial times;
2. list and identify the major linguistic groups in Nigeria;
3. explain the gradual evolution of Nigeria as a political unit;
4. analyse the concepts of Trade, Economic and Self-reliance status of the Nigerian peoples towards national development;
5. enumerate the challenges of the Nigerian State towards Nation building;
6. analyse the role of the Judiciary in upholding people's fundamental rights;
7. identify acceptable norms and values of the major ethnic groups in Nigeria; and
8. list and suggest possible solutions to identifiable Nigerian environmental, moral and value problems.

Course Contents
Nigerian history, culture and art up to 1800 (yoruba, hausa and igbo peoples and culture, peoples and culture of the ethnic minority groups). Nigeria under colonial rule: (advent of colonial rule in Nigeria, Colonial administration of Nigeria). Evolution of Nigeria as a political unit (amalgamation of Nigeria in 1914, formation of political parties in Nigeria, Nationalist movement and struggle for independence). Nigeria and challenges of nation building (military intervention in Nigerian politics; Nigerian civil war). Concept of trade and economics of self-reliance (indigenous trade and market system, indigenous apprenticeship system among Nigeria people, trade, skill acquisition and self-reliance). Social justices and national development (law definition and classification). Judiciary and fundamental human rights. Individual, norms, and values (basic Nigeria norms and values, patterns of citizenship acquisition, citizenship and civic responsibilities, indigenous languages, usage, and development, negative attitudes and conducts. Cultism, kidnapping and other related social vices). Re-orientation, moral and national values (The 3R's – reconstruction, rehabilitation and re-orientation strategies, operation feed the nation (OFN), green revolution, austerity measures, war against indiscipline (WAI), war against indiscipline and corruption (WAIC), mass mobilization for self-reliance; social justice and economic recovery (MAMSER), national orientation agency (NOA), current socio-political and cultural developments in Nigeria).

MTH 101: Elementary Mathematics I (Algebra and Trigonometry) (2 Units C: LH 30)

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

1. explain the basic definition of set, subset, union, intersection, complements and use of Venn diagrams;

2. solve quadratic equations;
3. solve trigonometric functions;
4. identify and use various types of numbers; and
5. solve some problems using binomial theorem.

Course Contents

Elementary set theory, subsets, union, intersection, complements, Venn diagrams. Real numbers; integers, rational and irrational numbers, mathematical induction, real sequences and series, theory of quadratic equations, binomial theorem. Complex numbers; algebra of complex numbers; the Argand diagram. De-Moivre's theorem, nth roots of unity. Circular measure, trigonometric functions of angles of any magnitude,
addition and factor formulae.

MTH 102: Elementary Mathematics II (Calculus) (2 Units C: LH 30)

Learning Outcomes

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

1. identify the types of rules of differentiation and integration;
2. describe the meaning of function of a real variable, graphs, limits and continuity and their applications; and
3. solve some applications of definite integrals in areas and volumes.

Course Contents

Function of a real variable (graphs, limits, and idea of continuity). The derivative as limit of rate of change. Techniques of differentiation. Extreme curve sketching. Integration as an inverse of differentiation. Methods of integration. Definite integrals (application to areas and volumes).

COS 101: Introduction to Computing Sciences (3 Units C: LH 30; PH 45)

Learning Outcomes

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

1. explain basic components of computers and other computing devices;
2. describe the various applications of computers;
3. explain information processing and its roles in the society;
4. describe the Internet, its various applications and its impact;
5. explain the different areas of the computing discipline and its specializations; and
6. demonstrate practical skills on using computers and the internet.

Course Contents

Brief history of computing. Description of the basic components of a computer/computing device. Input/Output devices and peripherals. Hardware, software and human ware. Diverse and growing computer/digital applications. Information processing and its roles in society. The Internet, its applications and its impact on the world today. The different areas/programs of the computing discipline. The job specializations for computing professionals. The future of computing.

Lab Work: Practical demonstration of the basic parts of a computer. Illustration of different operating systems of different computing devices including desktops, laptops, tablets, smart boards and smart phones. Demonstration of commonly used applications such as word processors, spreadsheets, presentation software and graphics. Illustration of input and output devices including printers, scanners, projectors and smartboards. Practical demonstration of the Internet and its various applications. Illustration of browsers and search engines. How to access online resources.

PHY 101: General Physics I (Mechanics) (2 Units C: LH 30)

Learning Outcomes

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

1. identify and deduce the physical quantities and their units;
2. differentiate between vectors and scalars;
3. describe and evaluate motion of systems on the basis of the fundamental laws of mechanics;
4. apply Newton's laws to describe and solve simple problems of motion;
5. evaluate work, energy, velocity, momentum, acceleration, and torque of moving or rotating objects;
6. explain and apply the principles of conservation of energy, linear and angular momentum;
7. describe the laws governing motion under gravity; and
8. explain motion under gravity and quantitatively determine behaviour of objects moving under gravity.

Course Contents

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

PHY 102: General physics II (Electricity & Magnetism) (2 Units C: LH 30)

Learning Outcomes

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

1. describe the electric field and potential, and related concepts, for stationary charges;
2. calculate electrostatic properties of simple charge distributions using Coulomb's law, Gauss's law, and electric potential;
3. describe and determine the magnetic field for steady and moving charges;

4. determine the magnetic properties of simple current distributions using Biot-Savart and Ampere's law;
5. describe electromagnetic induction and related concepts and make calculations using Faraday and Lenz's laws;
6. explain the basic physical of Maxwell's equations in integral form;
7. evaluate DC circuits to determine the electrical parameters; and
8. determine the characteristics of ac voltages and currents in resistors, capacitors, and Inductors.

Course Contents

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

PHY 103: General physics III (Behaviour of Matter) (2 Units C: LH 30)

Learning Outcomes

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

1. explain the concepts of heat and temperature and relate the temperature scales;
2. define, derive, and apply the fundamental thermodynamic relations to thermal systems;
3. describe and explain the first and second laws of thermodynamics, and the concept of entropy;
4. state the assumptions of the kinetic theory and apply techniques of describing macroscopic behaviour;
5. deduce the formalism of thermodynamics and apply it to simple systems in thermal equilibrium; and
6. describe and determine the effect of forces and deformation of materials and surfaces.

Course Contents

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

PHY 104: General Physics IV (Vibration Waves and Optics) (2 Units C: LH 30)

Learning Outcomes

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

1. describe and quantitatively analyse the behaviour of vibrating systems and wave energy;
2. explain the propagation and properties of waves in sound and light;
3. identify and apply the wave equations; and
4. explain geometrical optics and principles of optical instruments.

Course Contents
Simple harmonic motion (SHM). Energy in a vibrating system. Damped SHM. Resonance and transients. Coupled SHM. Q values and power response curves. Normal modes. Waves (types and properties of waves as applied to sound). Transverse and longitudinal waves (superposition, interference, diffraction, dispersion, polarization). Waves at interfaces (energy and power of waves. The wave equation. 2-D and 3-D wave equations. Wave energy and power. Phase and group velocities. Echo and beats. The Doppler-effect. Propagation of sound in gases, solids and liquids and their properties. Optics: Nature and propagation of light. Reflection and refraction. Internal reflection. Scattering of light. Reflection and refraction at plane and spherical surfaces. Thin lenses and optical instruments. Wave nature of light. Dispersion. Huygens's principle (Interference and diffraction).

PHY 107: General Practical Physics I (1 Unit C: PH 45)

Learning Outcomes
At the end of the course, students should be able to:
1. conduct measurements of some physical quantities;
2. make observations of events, collect and tabulate data;
3. identify and evaluate some common experimental errors;
4. plot and analyse graphs; and
5. draw conclusions from numerical and graphical analysis of data.

Course Contents
This introductory course emphasizes quantitative measurements. Experimental techniques. The treatment of measurement errors. Graphical analysis. The experiments include studies of meters, the oscilloscope, mechanical systems, electrical and mechanical resonant systems, light, heat, viscosity, etc. (covered in PHY 101, 102, 103 and PHY 104). However, emphasis should be placed on the basic physical techniques, for observation measurements, data collection, analysis, and deduction.

PHY 108: General Practical Physics II (1Unit C: PH 45)

Learning Outcomes
At the end of the course, students should be able to:
1. conduct measurements of some physical quantities;
2. make observations of events, collect and tabulate data;
3. identify and evaluate some common experimental errors;
4. plot and analyse graphs;
5. draw conclusions from numerical and graphical analysis of data; and
6. prepare and present practical reports.

Course Contents

This practical course is a continuation of PHY 107 and is intended to be taught during the second semester of the 100 level to cover the practical aspect of the theoretical courses that have been covered with emphasis on quantitative measurements, the treatment of measurement errors, and graphical analysis. However, emphasis should be placed on the basic physical techniques for observation, measurements, data collection, analysis and deduction.

BHU-PHY 109 Science of Materials (2 units; Core; L = 30)

Senate-approved relevance

The science of material teaches us what things are made of and why they behave as they do. It studies the relations between the structure and properties of materials. Innovations in both research and industry are driven by the knowledge of the science of materials. Knowledge of materials' composition and the techniques to manipulate their properties and functionality through the control of their structure and processing techniques are essential for research and innovations which is in line with Bingham University vision and mission to produce graduates that are equipped with both knowledge and skills in self-reliance with the fear of God.

Overview

When the relationships between the structure, properties, and processing of materials are fully understood and exploited, materials become enabling, they are transformed from raw materials that nature gives us, to things, the products and technologies that we develop as scientists and engineers.

This course teaches the concept principles that determines the mechanical properties of materials. The non-crystalline materials such as glasses, amorphous, semiconductors, and fiber optics will be studied. Other topics to be studied are organic materials, surfaces, interfaces and nanomaterials. Student will understand different techniques for imaging Nano structures. The electrical and thermal properties of different materials types shall be discussed. The objectives, learning outcomes and course contents for the course are provided in the foregoing section.

Objectives

The objectives of this course are to:

1. differentiate between ductility and hardness
2. distinguish between toughness and hardness
3. explain glass transition temperature
4. distinguish between cis and trans polymers
5. explain steel phase diagram
6. state the interface properties
7. outline the principles of imaging techniques in Nano structures
8. differentiate between amorphous semiconductor and fiber optics.

Learning Outcomes

After successfully completing the course, the student should be able to:

1. list two (2) differences between ductility and hardness;
2. mention two (3) differences between toughness and hardness;

3. calculate transition temperature of two (2) materials;
4. enumerate five (5) properties of cis and trans polymers;
5. sketch and label the steel phase diagram;
6. list six (6) interface properties of materials;
7. explain four (4) principles of imaging techniques in Nano structures and;
8. list five (5) properties amorphous semiconductor and fiber optics.

Course Contents
General introduction of materials. Classification of materials. Atomic structure. Atomic and ionic arrangement. Atoms and movement in materials. Mechanical properties of materials. Non–Crystalline materials (glasses, fiber optics, amorphous and semiconductors). Organic materials. Conducting polymers. Organic metal and alloys (steel, phase diagram). Surfaces (reconstruction, relaxation, work function). Interfaces. Magnetoresistance. Integral and fractional quantum hall effect. Nanomaterials. Imaging techniques. Electrical and thermal properties.

BHU-PHY 110 Scientific Equipment Procurement and Maintenance (1 unit; core; L = 15)

Senate-approved relevance
Equipment is often one of the biggest outlays in a laboratory. Scientific Equipment Procurement and Maintenance is a course design to make graduates of Bingham University knowledgeable and skilled on the procurement, purchasing and maintaining of laboratory equipment in order to avoid the equipment breakdown and enhancing innovative performance in the laboratory in line with its mission and vision to produce graduates that are equipped with knowledge and skills in self-reliance with the fear of God. Physicists must be grounded on how to acquire, set-up, effectively run and maintain the laboratory for experiments and research purposes. Understanding the technical details of specification and rating of equipment, analysing the performance characteristics and purchasing of scientific equipment is essential for a smooth running of a laboratory. The proximity of the university to other tertiary institutions and specialized laboratories will aid students in appreciating the importance of laboratories for research purposes.

Overview
This course is designed to teach students the process of setting up and managing of standard scientific laboratory for scientific research. Students will be exposed to different methods of scientific equipment installations and maintenance practices. The course also prepares students to know the estimated cost of establishing standard laboratory and possibly the running cost as an entrepreneur.

The course introduces students to the technical skills of procurements, specification and rating of equipment, market survey, quality control and general principles of equipment maintenance. The extension of the life span of equipment by correct usage and management shall be discussed. The objectives, learning outcomes and course contents for the course are provided in the foregoing section.

Objectives
The objectives of this course are to:
1. define and categorized different type of equipment;

2. explain specification and rating of equipment;
3. analyze the performance characteristics of different scientific equipment;
4. express how to maintain and troubleshoot of key scientific equipment;
5. identify scientific equipment suitable for use in the laboratory;
6. state the quality control in the laboratory;
7. state the importance of the proper operation, maintenance and repair service provision of machineries, equipment and tools;
8. list various methods of installations of laboratory equipment;
9. outline hazards associated with equipment and preventive measures and;
10. list the basics steps in calibration and validation of equipment.

Learning Outcomes

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

1. define and categorized four (4) different type of equipment;
2. explain specification and list four (4) ways of rating equipment;
3. critically analyse the performance characteristics of two (2) different scientific equipment;
4. explain how to maintain and troubleshoot of four (4) key scientific equipment;
5. identify one (1) scientific equipment suitable for use in the laboratory;
6. state two (2) quality control in the laboratory;
7. list two (2) importance of the proper operation, maintenance and repair service provision of machineries, equipment and tools;
8. list two (2) methods of installations of laboratory equipment;
9. outline three (3) hazards associated with equipment and preventive measure;
10. list two (2) basics steps in calibration and validation of equipment.

Course Contents

Equipment procurement processes. Categorization of equipment (electrical, mechanical). Instrumentation of selected laboratory equipment. Specifications and rating of equipment. Preparation, review and standardization of standard operating procedures of equipment. Equipment management. Quality control analysis. Environment and adoptability. Usage and reliability of equipment. Precision and tolerance of equipment. Basics steps in calibration and validation of equipment. Pricing (market survey, availability, funding capacity). Principle of equipment maintenance including laboratory management. Application of manual guide. Installations. Toolbox usage. Licensing. Hazard management.

BHU-PHY 111 General Chemistry I (2 units; core; L = 30)

Senate-approved relevance

The study of General Chemistry course will aid the understanding of the world around us. Chemical technologies enrich our quality of life in numerous ways by providing new solutions to problems in material and energy usage. Basic knowledge of chemistry will aid the understanding of Science of Material and Solid-State Physics. The acquisition of this knowledge will enable Bingham students appreciate the various properties and structures of the different states of matter. This is in line with fulfilment of the vision of Bingham University of producing graduates that are equipped with both knowledge and skills in self-reliance with the fear of God.

Overview
This course is designed to teach Chemistry from the ground up, beginning with the basics of the atom and its behaviour, then progressing to the chemical properties of matter and chemical changes and reactions that take place all the time in our world. This gives students a solid and diverse introduction to the world of Chemistry.

The course covers the qualitative and quantitative aspects of scientific measurement, the nature of matter, gases, liquids and solids, energy, atomic theory, properties of elements, periodic table, chemical bonding, molecular structure and properties, stoichiometry, thermochemistry and solutions. Problem solving are also a functional part of the course. The objectives, learning outcomes and course contents for the course are provided in the foregoing section.

Objectives
The objectives of this course are to:
1. describe the Modern electronic theory of atoms;
2. write electronic configurations of elements on the periodic table;
3. predict the trends of atomic radii, ionization energies, electronegativity of the elements based on their position in the periodic table;
4. identify and balance oxidation – reduction equation and solve redox titration problems;
5. illustrate shapes of simple molecules and hybridized orbitals;
6. identify the characteristics of acids, bases and salts, and solve problems based on their quantitative relationship;
7. 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;
8. analyze and perform calculations with the thermodynamic functions, enthalpy, entropy and free energy; and
9. determine rates of reactions and its dependence on concentration, time and temperature.

Learning Outcomes
At the end of this course, the students should be able to:
1. discuss one (1) electronic theory of atoms;
2. write electronic configurations of elements twenty (20) on the periodic table;
3. justify the trends of five (5) atomic radii, ionization energies, electronegativity of the elements based on their position in the periodic table;
4. identify and balance five (5) oxidation – reduction equation and solve redox titration problems;
5. illustrate four (4) shapes of simple molecules and hybridized orbitals;
6. identify three (3) characteristics of acids, bases and salts, and solve problems based on their quantitative relationship;
7. apply the principles of equilibrium to aqueous systems using LeChatelier's principle to predict two (2) effects of concentration, pressure and temperature changes on equilibrium mixtures;
8. analyse and perform two (2) calculations with the thermodynamic functions, enthalpy, entropy and free energy; and

9. determine rates of five (5) reactions and its dependence on concentration, time and temperature.

Course Contents
Atoms and molecules. Elements and compounds. 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.

BHU-PHY 112 Biophysics I (2 units; core; L = 30)

Senate-approved relevance
The study of biophysics is geared towards equipping students with the requisite knowledge of the application of Physics to biological systems in dealing with life threatening ailments stemming from allergic reactions to even the treatment of cancer. Biology, being the study of life, accommodates basic concepts of Physics in dealing with its applications to life in general. The concepts and techniques of biophysics find applications in bioelectronics, medicine/health, and population dynamics and are closely related to statistical mechanics and transport processes. In line with the mission of Bingham University to produce knowledgeable and self-reliant graduates in the fear of God, skills acquire from this course will impact positively on the health system within the circumference of Bingham University as well as touching the world at large. The course prepares graduates to be skilled, knowledgeable and competitive in pursuing careers or advanced degrees in the medical and biotechnical fields. The relevance of this course is found in the Sustainable Development Goal 3 which seeks to achieve good health and well-being for all.

Overview
Biophysics deals with the application of physics to biological systems, from the first picture of the structure of DNA, to the treatment of cancer, and the understanding of allergic reactions. The concepts and techniques of biophysics find applications in bioelectronics, medicine/health, and population dynamics and are related to statistical mechanics and transport processes.

This course provides an introduction to the physics of many body systems, kinematics in body systems, bioelectricity, transport phenomena and biological systems. This course develops foundational thinking and methods that are fundamental to an effective interdisciplinary STEM workforce. The objectives, learning outcomes and course contents for the course are provided in the foregoing section.

Objectives
The objectives of this course are 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;
4. explain solute transport in membranes;

5. explain models of biological systems and models dealing with statistical mechanics and transport phenomena;
6. describe the mechanisms of biological processes;
7. defines the physical variables that affect biological processes and;
8. evaluate the effects of physical variables occurring in living organisms.

Learning Outcomes
At the end of the course, students should be able to:
1. describe five (5) processes and effect five (5) of interactions of radiation with matter;
2. explain the two (2) concepts of electricity and magnetism at the cellular levels;
3. illustrate and explain four (4) effect of impulse in nerves and muscles;
4. explain three (3) solute transport mechanisms in membranes;
5. explain two (2) models of biological systems and two (2) models dealing with statistical mechanics and transport phenomena;
6. describe five (5) mechanisms of biological processes;
7. defines four (4) the physical variables that affect biological processes and;
8. evaluate four (4) effects of physical variables occurring in living organisms.

Course Contents
Molecules and Cells. Mesoscopic forces. Phase transitions. Motility. Aggregating and self-assembly. Surface phenomena. Bio macromolecules. Charged ions. Polymers. Rheology. Sensory motors. Kinetics. 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).

BHU-BST 104 Christian Belief (2 units; Elective; L = 30)

Senate-approved relevance
The world is fast changing and values are changing with it. What is clear to the Christian is that the Word of God does not change and it still remains the standard of belief and behaviour. This necessitates the stance of Bingham University on the Biblical perspective on Academic achievement. Bingham University believes that behaviour is sharpened by belief. So, The Bible Study Courses are created to bring peculiarity in the academic life of the institution. Christian Belief is enlisted under the General Studies Courses (GST). As a Faith-based institution, it is required to be studied by every student in the first year of academic study in Bingham University.

Overview
The Bible is vast and different teachings have been crafted from different school of thoughts in order to serve the purpose of those who crafted the teachings. So, this course is purposely designed to encourage students understand that the best way to know God and enjoy personal relationship with Him is to appropriate God's redemptive plan for their lives.

This course teaches students the fundamentals of the Christian faith. It is hopes to enlighten students to be deeply rooted in the knowledge of God, broaden their spiritual horizon, as well as help them build solid and excellent character. With this course, students are trained as spiritual giants in this end time to confront the wiles of the devil. The objectives, learning outcomes, and course contents for the course are provided in the foregoing sections.

Objectives
The objectives of the course are to:
1. describe the meaning of theology;
2. identify the types of theology;
3. state the purpose of theology;
4. describe the meaning of Trinity;
5. distinguish between Christology and Pneumatology;
6. list the types of Anthropology;
7. appraise the nature of Ecclesiology;
8. criticize the current understanding of Soteriology and Eschatology;
9. appraise the understanding of Angelology in some churches;
10. outline the content of Pneumatology.

Learning Outcomes
At the end of the course, students should be able to:
1. explain at least three (3) meanings of theology;
2. identify five (5) types of theology;
3. identify at least five (5) purposes of theology;
4. outline at least three (3) meanings of Trinity;
5. differentiate at least two (2) facts about Christology and Pneumatology;
6. list at least three (3) types of Anthropology;
7. identify at least five (5) nature of Ecclesiology;
8. describe at least two (2) current understandings of soteriology and eschatology;
9. appraise at least six (6) kinds of understanding of Angelology in at least five (5) church denominations and;
10. appraise ten (10) effects of demons' work in the world

Course contents
Definition of theology. Types of theology. The study of God. God the Father. God the Son. God the Holy Spirit. Study of the Bible-Bibliology. Lessons on Trinity. Comprehending Christology. Pneumatology. Anthropology. Study of the Church-Ecclesiology. Study on Salvation-Soteriology. Study of the events of the latter Days-Eschatology. Heaven and earth. Angelology. Demonology.

200 Level

GST 212: Philosophy, Logic and Human Existence (2 Units C: LH 30)

Learning Outcomes
A student who has successfully gone through this course should be able to:
1. know the basic features of philosophy as an academic discipline;
2. identify the main branches of philosophy & the centrality of logic in philosophical discourse;
3. know the elementary rules of reasoning;

4. distinguish between valid and invalid arguments;
5. think critically and assess arguments in texts, conversations and day-to-day discussions;
6. critically asses the rationality or otherwise of human conduct under different existential conditions;
7. develop the capacity to extrapolate and deploy expertise in logic to other areas of knowledge, and
8. guide his or her actions, using the knowledge and expertise acquired in philosophy and logic.

Course Contents

Scope of philosophy; notions, meanings, branches and problems of philosophy. Logic as an indispensable tool of philosophy. Elements of syllogism, symbolic logic— the first nine rules of inference. Informal fallacies, laws of thought, nature of arguments. Valid and invalid arguments, logic of form and logic of content — deduction, induction and inferences. Creative and critical thinking. Impact of philosophy on human existence. Philosophy and politics, philosophy and human conduct, philosophy and religion, philosophy and human values, philosophy and character moulding, etc.

ENT 211: Entrepreneurship and Innovation (2 Units C: LH 15; PH 45)

Learning Outcomes

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

1. explain the concepts and theories of entrepreneurship, intrapreneurship, opportunity seeking, new value creation, and risk taking;
2. state the characteristics of an entrepreneur;
3. analyse the importance of micro and small businesses in wealth creation, employment, and financial independence; and
4. engage in entrepreneurial thinking;
5. identify key elements in innovation;
6. describe stages in enterprise formation, partnership and networking including business planning;
7. describe contemporary entrepreneurial issues in Nigeria, Africa, and the rest of the world and;
8. state the basic principles of e-commerce.

Course Contents

Concept of entrepreneurship (entrepreneurship, intra/corporate entrepreneurship). Theories, rationale, and relevance of entrepreneurship (Schumpeterian and other perspectives. Risk-taking, necessity and opportunity-based entrepreneurship and Creative deduction. Characteristics of entrepreneurs (opportunity seeker, risk taker, natural and nurtured, problem solver and change agent, innovator, and creative thinker). Entrepreneurial thinking (critical thinking, reflective thinking, and creative thinking). Innovation (concept of innovation, dimensions of innovation, change and innovation, knowledge, and innovation). Enterprise formation. Partnership and networking (basics of business plan, forms of business ownership, business registration and forming alliances and join ventures). Contemporary entrepreneurship issues (knowledge, skills and technology, intellectual property, virtual office, networking).

Entrepreneurship in Nigeria (biography of inspirational entrepreneurs, youth and women entrepreneurship. Entrepreneurship support institutions. Youth enterprise networks and environmental and cultural barriers to entrepreneurship). Basic principles of e-commerce.

PHY 201: General physics IV (Elementary Modern Physics) (2 Units C: LH 30)

Learning Outcomes

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

1. explain the notion of an inertial frame and the concept of an observer;
2. relate the limitations imposed by and consequences of motion of bodies at the speed of light;
3. state the principles of Special Relativity and use them to derive relations for time dilation and length contraction;
4. perform calculations using the Lorentz transformation formulae;
5. derive relativistic energy and momentum and use these to solve problems in mechanics;
6. apply the mathematical treatment of the wave function and Schrodinger's equation;
7. relate the atomic structure and energy associated with the particles of the atom;
8. apply the ideas of a wave-particle duality and the uncertainty principle to solve problems in quantum mechanics;
9. apply the Bohr formula to calculate energies and wavelengths in the context of atomic hydrogen; and
10. explain the interaction of photons and electrons with matter.

Course Contents

Defects in Newtonian Mechanics. Galilean relativity. The speed of light. Inertial frames and the concept of an observer. The principles of Einstein's Special Theory of Relativity. Lorentz transformation. Time dilation and length contraction. Transformation of velocities. Doppler effect. Relativistic energy and momentum. Basic properties of atoms and molecules. Experimental basis of quantum theory. Electrons and quanta. Bohr's theory of atomic structure. Energy levels and spectra. De Broglie hypothesis. The uncertainty principle. Black body radiation. The momentum operator. Time-independent Schrödinger equation. The infinite square well. Simple applications in particle and nuclear physics. Compton effect. Thermionic emission. Radioactivity. Detection and measurement of charged particles (including the treatment of detectors). X-rays.

PHY 202: Introduction to Electric Circuits and Electronics (2 Units C: LH 30)

Learning Outcomes

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

1. identify circuit diagrams and symbols;
2. determine current flows, potential drops, power, and energy dissipation in circuits using Ohm's law;
3. simplify series and parallel combinations of resistors;
4. state Kirchhoff's laws and apply same in solving for currents and voltages in dc. and ac. circuits;
5. apply potential divider and current divider techniques in calculating circuit potential differences and branch currents;

6. state and apply circuit theorems and principles to solve problems;
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. analyse a.c. circuits using phasor diagrams;
10. determine power, Q-factor, and resonance in ac. circuits;
11. explain the principle of the transformer and applications;
12. distinguish between conductors, semiconductors, and insulators and explain crystal and band structure;
13. identify semiconductor devices and explain their principle of operation;
14. explain the current – voltage characteristics of semiconductor devices; and
15. explain the function of semiconductor devices (diodes, transistors etc.)

Course Contents
D.C. Circuits. Sources of emf and current. Resistor combinations. Kirchhoff's Laws. Network analysis and circuit theorems. Mesh currents method, Node-voltage, Thevenin and Norton theorem, superposition principle. A.C. Circuits. Sinusoidal wave-forms. RMS and peak values. Power. Resistance, inductance and capacitance in a.c. circuits. Impedance and admittance. Series and parallel RLC circuits. Q factor. Resonance. The transformer. Electronics: filters. Amplification and the transistor. Bipolar junction and field effect transistors. Equivalent circuits. Amplifiers. Feedback. Oscillators. Signal generators. Semiconductors (devices and characteristics). The pn-junction. Simple diodes. Photodiodes. LEDs.

PHY 204: General Physics V (Waves and optics) (2 Units C: LH 30)

Learning Outcomes
At the end of the course, students should be able to:
1. describe the wave phenomena and explain the nature and properties of waves;
2. explain wave propagation in different media;
3. describe geometric optics and image formation;
4. analyse simple examples of interference and diffraction phenomena;
5. identify and explain functions of optical devices;
6. explain the principles of optical instruments and applications;
7. explain the principles of operation of the Michelson interferometer;
8. describe the polarization states of light.

Course Contents
Wave phenomena (types and properties of waves). SHM. Harmonic oscillator. Waves on a string. Energy in wave motion. Longitudinal waves. Standing waves. Acoustical waves. Group and phase velocities. Doppler effects. Physical Optics: Spherical waves. Interference. Superposition. Young's slits. Single and double slits. Multiple slits. The Michelson interferometer. Diffraction. The diffraction grating and spectrometers. Thin films. Dispersion and scattering. Echo and beats. Sound in gases, liquids, and solids. Geometrical optics (waves and rays). Reflection at plane and spherical surfaces. Refraction. Thin lenses. Prism. Optical lenses and optical instruments e.g., microscopes, telescopes, etc. Lens maker's formula. Polarization and polarization states.

Unpolarised and partially polarized light. Brewster's angle. Polarizing beam splitters. Photometry and light spectrum analysis.

PHY 205: Thermal Physics (2 Units C: LH 30)

Learning Outcomes

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

1. discuss the concept of heat and temperature;
2. explain and determine thermodynamic processes;
3. explain and evaluate properties of real and ideal gases;
4. evaluate the consequences of the thermodynamic laws;
5. describe the basis of the kinetic theory; and
6. describe the statistical behaviour of gases with applications.

Course Contents

The foundations of classical thermodynamics including the definition of temperature. The first law. Work, heat and internal energy. The second law. Carnot cycles and Carnot engines. Zeroth law. Entropy and irreversibility. Thermodynamic potentials and the Maxwell relations. Ideal gas equation. Internal energy and internal molecular modes. Qualitative discussion of phase transitions. Gibbs free energy. Clausius-Clapeyron equation. Examples of phase transitions. Vander Waals gas. Kinetic theory. Mean free path. Equi-partition of energy. Heat transfer. Diffusion rate.

PHY 206: General Physics VI (Energy and Environment) (2 Unit C: LH 30)

Learning Outcomes

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

1. explain the origin and sources of energy and power;
2. describe the inter relation and transformation of energy sources and types;
3. illustrate and explain the principles of generation of power;
4. outline the concept of energy demand and supply;
5. explain the economics, politics and problems associated with energy demand and supply;
6. identify and assess categories of environmental pollutants;
7. describe effect of carbon emission on global warming;
8. describe the environmental effect of energy generation, supply, and consumption; and
9. identify and evaluate the merits and demerits of power generation from different sources.

Course Contents

Energy sources and climate impacts. Energy requirements and consumption. Energy processing and conversion. Energy units and pricing. The greenhouse effect. Biological forms of energy (fossil fuels and biofuels). Basic nuclear physics. The atom, radioactivity and decay laws. Interaction of radiation with matter. Nuclear fission principles and energetics. Chain reaction and dynamics. Reactor types and control. Current status of nuclear fission as a power source. Nuclear fusion principles and energetics. (Examples in stars and on earth). Thermonuclear fusion. Nuclear fuels.

Ignition and the Lawson criterion. Magnetic and inertial confinement. Current status of nuclear fusion as a power source. Stellar fusion. Proton-proton chain and CNO cycle. Solar power technologies. Solar thermal. Solar photovoltaic. Wind energy. Nature of wind. Wind power and wind turbines. Betz criterion. Energy from waves and tides. Principles of water waves, energy, and power. Wave power extraction. Origin and properties of tides. Tidal stream power and tidal range power. Power from fluids. Hydro power. Energy transportation and storage. Thermal pollution. Energy costs, capacity, reserves, and efficiency. Emerging environmental effects of energy processing.

PHY 207/208: Experimental Physics I & II (2 Units C: PH 90)

Learning Outcomes

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

1. identify the two physical quantities to be measured as independent and dependent variables;
2. determine the relationship between the two variables in form of graph;
3. determine some physical constants such as acceleration due to gravity, force constant of a spring, refractive index of a prism and focal length of converging and diverging lenses using different methods; and
4. determine momentum of inertia of a fly wheel and determine coefficient of static and dynamic friction for wood.

Course Contents

The laboratory course consists of a group of experiments drawn from diverse areas of Physics (optics, electromagnetism, mechanics, Modern Physics, etc.). It is accompanied by seminar studies of standard experimental techniques and the analyses of famous and challenging experiments.

PHY 211: Workshop Practice (2 Units C: LH 15; PH 45)

Learning Outcomes

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

1. identify safety signs for various workshop types and abide by the underlining regulations while working in the workshop;
2. handle workshop tools and machineries;
3. illustrate simple metal processing methods;
4. describe the criteria for selection of construction materials;
5. identify electrical and electronic devices and explain some instrumentation techniques for measuring parameters;
6. explain types and methods of wood and plastic processing.

Course Contents

Workshop layout and safety. Basic hand tools and bench work practices. Measurement and gauging. Sheet metal operations. Casting. Cutting, drilling, turning, and milling. Metal joining devices and adhesives in common use. Soldering techniques and wrap joints. Plain and cylindrical generation of smooth surface using power operated machines. Criteria for selection of materials used for construction (metallic and non-metallic). Instrumentation and measuring techniques.

Multi-meters and oscilloscopes. Extension of instrument range. A survey of the use of electronic circuit devices (e.g., diodes, transistors including FET, integrated circuits). Photocells. Basic circuit development and analysis. Wood logging. Wood types and processing. Plastic types and working. Plastic moulding, bending, and encapsulation.

BHU-PHY 209 Classical Physics I (2 units; Core; L = 30)

Senate-approved relevance

Classical mechanics is used for describing the motion of macroscopic objects, from projectiles to parts of machinery, as well as astronomical objects, such as spacecraft, planets, stars, and galaxies. It produces very accurate results within these domains, and is one of the oldest and largest subjects in science, engineering and technology. This is in line with Bingham University's vision and mission to produce graduates equipped with both knowledge and skills in self-reliance with the fear of God. Classical Mechanics is important to teach the physical theory which has greatly influenced the style of modern physics. Classical Mechanics is required to understand quantum mechanics, field theory, statistical mechanics and elementary particles. It led directly to microscopic models for the behaviour of matter. Bingham's graduate can use this knowledge to predict with great precision a wide variety of phenomena ranging from the motion of individual particles to the interactions of highly complex systems and to be able to understand quantum mechanics which is the basis of research in MRI scanners for medical imaging, lasers, solar cells, electron microscopes and atomic clocks used for GPS.

Overview

Classical mechanics is the study of the motion of bodies (including the special case in which bodies remain at rest) in accordance with the general principles first enunciated by Sir Isaac Newton in his Philosophiae Naturalis Principia Mathematica (1687), commonly known as the Principia. Classical mechanics was the first branch of Physics to be discovered, and is the foundation upon which all other branches of Physics are built. Moreover, classical mechanics has many important applications in other areas of science, such as Astronomy (celestial mechanics), Chemistry (the dynamics of molecular collisions), Geology (the propagation of seismic waves, generated by earthquakes, through the Earth's crust), and Engineering (the equilibrium and stability of structures).

The course introduces and explains the concept of constraints, generalized coordinates, motion under central conservative forces, scattering, Kepler's law, Motion in non-inertia frames of reference, the Lagrange and Hamilton's formulation of mechanics. The objectives, learning outcomes and course contents for the course are provided in the foregoing section.

Objectives

The objectives of this course are to:

1. relate the concepts of space coordinates, time, and linear motion;
2. describe particle dynamics, equilibrium, and conservative forces;
3. solve problems on central forces, energy, and angular momentum;
4. explain the dynamics of rotational motion;
5. discuss and apply the potential theory;
6. explain the dynamics of rigid bodies;

7. apply Newton's theory of gravitation to problems of planetary motion and space travel;
8. use inertial forces to explain motion from the viewpoint of rotating frames of reference; and;
9. derive the general relation between the angular velocity and angular momentum of a rigid; body and use this to solve problems in rotational dynamics.

Learning Outcomes

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

1. write two (2) equations relating the space coordinates, time, and linear motion;
2. discuss particle dynamics, equilibrium, and conservative forces;
3. solve five (5) problems each on central forces, energy, and angular momentum;
4. enumerate four (4) the dynamics of rotational motion;
5. discuss and apply the potential theory;
6. explain four (4) the dynamics of rigid bodies;
7. apply Newton's theory of gravitation to five (5) problems of planetary motion and space travel;
8. use inertial forces to explain motion from the viewpoint of rotating frames of reference; and;
9. derive the general relation between the angular velocity and angular momentum of a rigid; body and use this to solve five (5) problems in rotational dynamics.

Course Contents

Introduction to classical mechanics. Space and time. Generalized coordinates and constraints. Inertia and non-inertial frame. Conservative and non-conservative forces. Equi-partition of energy. Virtual work, Virtual Displacement and Generalized Forces. Lagrange’s formulation of mechanics. Hamilton’s formulation of mechanics. d’Alembert’s Principle of Virtual Work. Lagrangian Mechanics. Hamiltonian Mechanics. Central force and scattering. The Generic Central Force Problem. Kepler’s Problem. Scattering Cross Section. Time Derivative in Fixed and Rotating Frames. Motion Relative to Earth.

BHU-PHY 210 Classical Physics II (Electrodynamics) (2 units; Core; L=30)

Senate-approved relevance

Classical electromagnetism or classical electrodynamics is a branch of theoretical physics that studies the interactions between electric charges and currents using an extension of the classical Newtonian model. Both magnetic fields and electric voltages (caused by an electric field) play an important role in electrodynamics. Almost all theories of modern physics are field theories, and electrodynamics has thus laid the foundation for modern physics. Electrodynamics explains the phenomena associated with charged particles in motion and changing electric and magnetic fields. This critical thinking and problem-solving abilities are in line with the vision of Bingham University to produce graduates that knowledgeable and self-reliant in the fear of God. This course provides a unique understanding of nature and is often the starting point for advanced studies.

Overview

The course provides an introduction to electrodynamics and a wide range of applications including communications, superconductors, plasmas, novel materials, photonics and astrophysics.

Electrodynamics is one of the oldest and best studied theories in physics. It deals in a fundamental way with the motion and behaviour of electrically charged particles and currents. In addition, it also describes magnetism, which is closely related to electricity.

The course introduces the recent development in quantum electrodynamics, which was formulated to explain the interaction of electromagnetic radiation with matter, to which the laws of the quantum theory apply. The basic laws to be studied includes: Gauss's law, Gauss's law for magnetic fields, Law of induction, Ampère's law and Maxwell's equations. The objectives, learning outcomes and course contents for the course are provided in the foregoing section.

Objectives

The objectives of this course are:

1. define electrodynamics;
2. explain the motion and behaviour of electrically charged particles and currents;
3. explain the basic mathematical concepts related to electromagnetic vector fields;
4. enumerate the concepts of electrostatics, electric potential, energy density and their applications;
5. identify the concepts of magneto statics, magnetic flux density, scalar and vector potential and its applications.
6. explain the concepts of Faraday's law, induced emf and Maxwell's equations.
7. solve Poisson's equation and the inhomogeneous wave equation; and
8. analyse Maxwell's equations and their basic applications.

Learning Outcomes

On completion, the students should be able to:

1. define electrodynamics;
2. explain the motion and behaviour of two (2) electrically charged particles and currents;
3. list four (4) basic mathematical concepts related to electromagnetic vector fields;
4. state two (2) concepts of electrostatics, electric potential, energy density and their applications;
5. define magneto statics, magnetic flux density, scalar and vector potential and list four (4) applications;
6. state Faraday's law, induced emf and apply four (4) Maxwell's equations;
7. solve five (5) problems on Poisson's equation and the inhomogeneous wave equation;
8. analyse four (4) Maxwell's equations and their basic applications.

Course Contents

Maxwell's equations and wave solutions. Electrostatics and magneto statics. Electrodynamics in Lorentz Gauge. The inhomogeneous wave equation and the retarded time. Relativistic dynamics. Electromagnetic field tensor. Power radiated from an arbitrary moving charge. Multiple radiation, electric and magnetic dipole radiation (slow-down of pulsars). Rayleigh and Thomson scattering. Boundary value problems for static and time-varying fields. Electromagnetic fields in materials (including dielectrics, magnetic materials, conductors, plasmas and metamaterials). Electromagnetic waves. Derivation of geometric optics from Maxwell's equations. Guided waves. relativistic electrodynamics. Covariant formulation of electrodynamics. Radiation by antennas. Accelerating charged particles.

BHU-PHY 213 Solid State Physics I (2 units; Core; L = 30)

Senate-approved relevance

Solid State Physics forms the theoretical basis of Materials Science. It also has direct applications to technology. Solid State Physics is a very large, very broad physics sub-field! It is the largest branch of Materials Science**.** An important motivation for the study of Solid-State Physics is the fact that the microscopic properties it deals with are responsible for the majority of modern technology. These properties determine the mechanical strength of materials, how they interact with light, how they conduct electricity, etc. So, Solid State Physics is an important subject for technology, that will guide students on how to design the circuits needed for modern electronic devices. This field, led to the production of transistor & the semiconductor chip. For these reasons, Solid State Physics has been traditionally linked to materials science, chemistry & engineering. Recently, it has also developed overlaps with biology, biochemistry, biotechnology & medicine. So, many current research questions in Solid State Physics are at the frontiers of applied science & next-generation technologies**.** In furtherance of Bingham University's vision to produce knowledgeable and self-reliant graduates with the fear of God skills acquired will be relevant for research at the undergraduate and post graduate levels.

Overview

This course provides an introduction to solid-state physics at the advanced undergraduate level. Solid-state physics is the study of the properties of solid materials and how they emerge quantum mechanically from their constituent atoms. It is the largest sub-branch of condensed matter physics, which is a primary research area in modern physics, materials science, and electrical engineering. This subject is typically first introduced to undergraduates in their third or fourth year of study.

Thematically, the course introduces a series of physical models that describe the real behaviour of solids at increasingly accurate levels. For example, in the first few weeks, you study the Drude (classical) and Sommerfeld (quantum) models of solids, which assume that solids are an idealized non-interacting electron gas. Next, crystal structure and periodic potentials of real solids are introduced. Topics covered in this part include: Bloch states, band structure of insulators, conductors, and semiconductors, perturbation theory, and the tight-binding approximation. Finally, in the last few weeks of the course, the concepts of phonons and harmonic crystals are introduced. This curriculum provides a solid foundation for further coursework in condensed matter physics and materials science. The objectives, learning outcomes and course contents for the course are provided in the foregoing section.

Objectives

The objectives of this course are to:

1. outline the importance of solid-state physics in the modern society;
2. distinguish the relationships between chemical bonding & crystal structure and their defects;
3. state the basic properties of metals, insulators and semiconductors and their technological applications;

4. demonstrate knowledge of arrangement of atoms, crystal, lattice, unit cell, translational vector;
5. explain the basic physical principles underlying a variety of fundamental phenomenon in solid state;
6. classify solid state matter according to their bandgap;
7. explain the characteristic physical properties of different categories of solid materials, with an emphasis on the crystalline state;
8. explain a wide spectrum of theoretical approach to model the mechanical, thermal and electrical properties of solid materials;
9. define superconductivity and qualitatively relate it to lattice vibration and density of states;
10. describe theoretical fundamentals of electron theory and super conductivity.

Learning Outcomes

Upon completion of the course, the student should be able to:

1. list five (5) importance of solid-state physics in the modern society;
2. express two (2) relationships between chemical bonding & crystal structure and their defects;
3. list five (5) basic properties of metals, insulators and semiconductors and their technological applications;
4. concisely demonstrate the knowledge of arrangement of atoms, crystal, lattice, unit cell, translational vector;
5. list four (4) basic physical principles underlying a variety of fundamental phenomenon in solid state;
6. classify the three (3) solid state matter according to their bandgap;
7. list five (5) physical properties of solid materials, with an emphasis on the crystalline state;
8. explain two (2) theoretical approach to model the mechanical, thermal and electrical properties of solid materials;
9. define superconductivity and qualitatively relate it to lattice vibration and density of states;
10. define super conductivity.

Course Contents

Basic concepts of the quantum theory of solids. The free electron models. Weak and Tight binding approximations. Energy band structures (metal, semiconductors and insulators). Physics of Schottky and surface devices. Use of photo-electric emission in the study of solids. Crystal structure and crystal binding. Elastic properties. Lattice vibrations. Transport properties. Elementary Crystallography. Polymorphism and Allotropy. X-ray diffraction. Crystal Planes. Electron Theory of Metals. Dielectric Properties. Magnetic Properties. Superconductivity.

BHU-PHY 215 Computer Programming I (3 units; core; L = 30; PH = 45)

Senate-approved relevance

The course produces graduates that are skilled in writing computer programs which are instructions given to the computer to carry out specified task. The students acquire knowledge that enable them understand codes for performing tasks, application design, and relevant knowledge for the development of technology for describing the features of text-based languages. The understanding of computer programming works in line with the vision and mission of Bingham University to produce graduates that are equipped with both knowledge and skills in self-reliance with the fear of God. This course prepares students to study Computational Physics at a higher level and gives the understanding of modelling and simulation for research purposes.

Overview

Computer Programming teaches students to write instructions for computer to perform specified tasks. Today computer programs are being used in almost every field, household, agriculture, medical, entertainment, defence, communication, etc. Computer programs are being used to develop graphics and special effects in movie making, to perform ultrasounds, x-Rays, and other medical examinations.

This course provides an introduction to computer and functional programming, scripting languages, object-orientation technique for modelling computation, typical object-oriented language: Java, data types, recursive algorithms and polymorphism. This course develops foundational thinking and methods that are fundamental to an effective interdisciplinary STEM workforce. The objectives, learning outcomes and course contents for the course are provided in the foregoing section.

Objectives

The objectives of this course are to:

1. identify different programming paradigms and their approaches to programming;
2. write programs using basic data types and strings;
3. design and implement programming problems using selection;
4. design and implement programming problems using loops;
5. use and implement classes as data abstractions in an object-oriented approach;
6. implement simple exception handling in programs;
7. develop programs with input/output from text files; and
8. design and implement programming problems involving arrays.

Learning Outcomes

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

1. identify five (5) programming paradigms and their approaches to programming;
2. Write two (2) programs using basic data types and strings;
3. design and implement four (4) programming problems using selection;
4. design and implement four (4) `programming problems using loops;
5. use and implement two (2) classes as data abstractions in an object-oriented approach;
6. Implement one (1) simple exception handling in programs;
7. develop programs five (5) with input/output from text files; and
8. design and implement four (4) programming problems involving arrays.

Course Contents
Introduction to computer programming. Functional programming (Declarative programming). Logic programming. Scripting languages. Introduction to object-orientation as a technique for modelling computation. Introduction of a typical object-oriented language: Java. Basic data types (variables, expressions, assignment statements and operators). Basic object-oriented concepts (abstraction, objects, classes and methods). Parameter passing. Encapsulation. Introduction to Strings and string processing. Simple I/O. Control structures. Arrays. Recursive algorithms. Inheritance. Polymorphism.

BHU-BST 203 Christian Worldview I (1 unit; Elective; L= 1)

Senate-approved relevance
The study of Worldview and ethics is connected to what is called Moral Theology. At graduation, students are awarded degrees based on their qualification academically and morally. This course is a course designed specifically to teach Christian morals to the students and is in line with Bingham University's vision to produce knowledgeable and self-reliant graduates with the fear of God. As a faith-based institution, it is inevitable to give solid teaching and direction to our students on the issue of morality. This is the fort of this course. It is however, divided into two, to be taught in the second year of academic
activities in both the first and second semesters.

Overview
Belief is necessary for behaviour in the community. Worldview also determines outlook in life. Objectivity or subjectivity in life is determined by one's worldview. So, after understanding Christian belief, which is foundational, the next is the course in Christian worldview. This course is designed to revive the understanding of the student on rudimentary knowledge and essentials of the Christian worldview.

This course teaches students the essentials of Christian worldview and guides them on which one to adopt. Students are expected to seek proper knowledge of the Christian worldview. Knowledge gained as a result of this course enable students to withstand the storms of this world. Their exposure to other conflicting religious worldviews stabilizes them among their peers. The objectives, learning outcomes, and course contents for the course are provided in the foregoing sections.

Objectives
The objectives of the course are to:
1. describe the relationship between culture and worldview;
2. identify different epochs;
3. classify different worldviews in succeeding historical eras;
4. enumerate the origin of man;
5. list the purpose of man in different worldview;
6. appraise the African worldview;
7. enumerate the Buddhist and Hinduist's worldview;
8. classify the Islamic and Judeo-Christian worldview;
9. differentiate between creation and evolution worldview;

10. explain the meaning of metaphysical worldview;
11. describe the marks of cults in post-modern world.

Learning Outcomes

Upon completion of the course, the student should be able to:

1. describe two (2) relating factors between culture and worldview;
2. identify at least five (5) different epochs;
3. classify three (3) different worldviews in succeeding eras;
4. enumerate at least four (4) views about the origin of man;
5. list five (5) purposes of man in different worldviews;
6. describe at least four (4) characteristics of African worldview;
7. enumerate 4 features of Hindus and Buddhists' worldviews;
8. identify four (4) distinguishing features of Islamic and Judeo-Christian worldview;
9. list four (4) differences between creation and evolution worldviews;
10. enumerate the meanings of metaphysical worldviews; and
11. describe four (4) different marks of cults in post-modern world.

Course Content

Definition of culture and worldview. Understanding the epochs. Identifying the worldviews in the succeeding historical era. Origin of man. Purpose of man in different worldview. The African worldview. The Buddhists' worldview. The Hinduists' worldview. The Islamic worldview. The Judeo-Christian worldview. Creation or evolution. Darwinism and its flaws. Metaphysical. Postmodernism. Marks of cults. Understanding and defining truth. Developing a Christian worldview.

BHU-BST 204 Christian Worldview II (1 unit; Elective; L= 15)

Senate-approved relevance

Study of worldview and ethics is connected to what is called Moral Theology. At graduation, students are awarded degrees based on their qualification academically and morally. This course is a course designed specifically to teach Christian morals to the students and is in line with Bingham University's vision to produce knowledgeable and self-reliant graduates with the fear of God. As a faith-based institution, it is inevitable to give solid teaching and direction to our students on the issue of morality. This is the fort of this course. It is however, divided into two, to be taught in the second year of academic activities in both the first and second semesters. This is the second part of the course.

Overview

Bingham University is a university anchored on the Evangelical Christian belief. This belief is adjudged accurate when the believer is seen acting in consonance with his/her belief. In an age where morals and behaviour are bedevilled by 'anything goes', a course on building solid morality becomes unavoidable. In addition, in order to churn out quality positively behaved graduates, a course anchored on solid moral worldview is a necessity.

This course teaches students the essentials of the Christian worldview. Students are instructed on the precepts to follow in order to secure a solid Christian worldview, in order to help them apply the acquired knowledge in their various facets of life. The acquired knowledge is expected to also help them stay equipped to confront other confusing ideologies. The objectives, learning outcomes, and course contents for the course are provided in the foregoing sections.

Objectives

The objectives of the course are to:

1. outline the connections between various worldviews and culture;
2. appraise the diver's scholars' worldviews;
3. demonstrate in clear terms the significance of worldviews;
4. identify the nature of various worldviews;
5. summarize the functions of worldviews;
6. compute the contextual views of interpreting history;
7. identify the realities of worldview;
8. list the categories of worldviews;
9. identify the major elements of worldview;
10. contrast the revelation of God with non-Christian worldviews;
11. describe postmodern ideologies of other faiths; and
12. recognize the contours of the Christian worldview.

Learning Outcomes

Upon completion of the course, the student should be able to:

1. outline at least five (5) connecting thoughts between various worldviews and culture;
2. identify five (5) divers' scholars' worldviews;
3. critique at least three (3) significance of worldviews;
4. demonstrate at least four (4) nature of various worldviews;
5. identify at least five (5) functions of worldviews;
6. illustrate at least three (3) contextual views of interpreting history;
7. recognize five (5) realities of worldview;
8. list at least three (3) categories of worldviews;
9. identify 5 major elements of worldview;
10. contrast five (5) aspects of revelation of God with non-Christian worldviews;
11. describe at least three (3) postmodern ideologies of other faiths; and
12. recognize at least 3 contours of the Christian worldview.

Course Content

Definition of concepts of worldview and culture II. The Analysis of scholars' conception of worldview. Significance of worldview. Nature of worldview. Functions of worldview. Contextual views of interpreting history and reality of worldview. The categories of worldviews. The major elements of worldviews. The question of the destiny of man. The revelation of God. The person of Christ. Postmodern ideologies of other faiths. Christian worldview and Christian religious cults. The model (contours) of Christian worldview

BHU-LEM 210 Leadership and mentorship (1 unit; Elective; L = 15)

Senate-approved relevance

Organizations fall or rise depends on the quality of leadership. It is leaders that drive achievements in organization. No leader no success. Good leaders good progress and bad leaders suffocate the organization. However, leaders are not born, they are developed and mentored, hence the necessity of this course. Producing reliable, efficient leaders and mentors is in furtherance of Bingham University's vision to produce knowledgeable and self-reliant graduates with the fear of God.

Overview

This course focuses on two major areas of leadership and mentorship. The leadership aspect summarizes the essentials of Christian leadership, how to become good leaders and how to impact one's generation through acquisition of necessary godly skills. The other parts enumerate how to align oneself to a leader so as to be taught the principles of leadership. This is the mentorship aspect. The course then continues on how to be both a mentor and a protégé.

The course equips students with the fundamentals of leadership. Area of emphasis include meaning of leadership, leadership skill acquisition, precepts of godly leadership and leadership development. It fortifies them with the knowledge on mentorship and developing leadership skills them, and strengthen them to build enduring mentorship and leadership pattern and lifestyle. The objectives, learning outcomes, and course contents for the course are provided in the foregoing sections.

Objectives

The objectives of the course are:

1. define the meaning of mentorship;
2. recognize God's purposes in life;
3. outline Core values of SWOT and SHAPE;
4. illustrate the strategies for mentorship;
5. develop personal strategic life plan;
6. demonstrate Being a mentor and becoming a mentor;
7. sketch Pattern for mentorship;
8. illustrate Action plans for purposeful priority areas in life;
9. write Introductory thoughts on leadership;
10. identify Fundamental values of leadership;
11. develop Leadership skills; and
12. describe the Essential of Team work.

Learning Outcomes

Upon completion of the course, the student should be able to:

1. illustrate at least three (3) ideological meanings of mentorship;
2. recognize five (5) of God's purposes in life;
3. outline at least three (3) Core values of SWOT and SHAPE;
4. design four (4) Strategies for mentorship;
5. develop at least two (2) personal strategic life plan;
6. demonstrate 3 factors for Being a mentor and becoming a mentor;
7. sketch at least 4 Patterns for mentorship;
8. illustrate at least 3 Action plans for purposeful priority areas in life;

9. outline at least 5 introductory thoughts on leadership;
10. identify at least 4 Fundamental values of leadership;
11. list at least 5 Leadership skills; and
12. describe 5 Essential of Team work.

Course contents
Meaning of mentorship. God's purposes in life. Core values of SWOT and SHAPE. Strategies for mentorship. Developing personal strategic life plan. Being a mentor and becoming a mentor. Pattern for mentorship. Action plan for purposeful priority areas in life. Introductory thoughts on leadership. Fundamental values of leadership. Leadership skills. The leader we need. Personality and experience of leaders. Essential of Team work. Acts of Delegation. Leader's relationship with God. Leader's relationship with his/her subject.

300 Level

GST 312: Peace and Conflict Resolution (2 Units C: LH 30)

Learning Outcomes
At the end of the course, students should be able to:
1. analyse the concepts of peace, conflict, and security;
2. list major forms, types and root causes of conflict and violence;
3. differentiate between conflict and terrorism;
4. enumerate security and peace building strategies;
5. describe roles of international organisations, media, and traditional institutions in peace building.

Course Contents
Concepts of peace, conflict and security in a multi-ethnic nation. Types and theories of Conflicts (ethnic, religious, economic, and geo-political conflicts). Structural conflict theory. Realist theory of conflict. Frustration-aggression conflict theory. Root causes of conflict and violence in Africa (Indigene and settlers' phenomenon; boundaries/boarder disputes; political disputes; ethnic disputes and rivalries; economic inequalities; social disputes). Nationalist movements and agitations. Selected conflict case studies – Tiv-Jukun; Zango Kartaf, chieftaincy and land disputes etc. Peace building. Management of conflicts and security. Peace & human development. Approaches to peace & conflict management --- (religious, government, community leaders etc.). Elements of peace studies and conflict resolution. Conflict dynamics assessment Scales (constructive & destructive). Justice and legal framework: Concepts of social justice; The Nigeria legal system. Insurgency and terrorism. Peace mediation and peace keeping. Peace & security Council (international, national and local levels). Agents of conflict resolution (conventions, treaties, community policing, evolution and imperatives. Alternative dispute resolution, ADR. a) Dialogue b) Arbitration c) Negotiation d) Collaboration etc. Roles of international Organizations in conflict resolution. (a) The United Nations, UN and its conflict resolution organs. (b) The African Union & Peace Security Council (c) ECOWAS in peace keeping. Media and traditional institutions in peace building. Managing post-conflict situations/crisis (Refugees. Internally displaced persons, IDPs0. The role of NGOs in Post-conflict situations/crisis.

ENT 312: Venture Creation (2 Units C: LH 15; PH 45)

Learning Outcomes

At the end of this course, students, through case study and practical approaches, should be able to:

1. describe the key steps in venture creation;
2. spot opportunities in problems and in high potential sectors regardless of geographical location;
3. state how original products, ideas, and concepts are developed;
4. develop business concept for further incubation or pitching for funding;
5. identify key sources of entrepreneurial finance;
6. implement the requirements for establishing and managing micro and small enterprises.
7. conduct entrepreneurial marketing and e-commerce;
8. apply a wide variety of emerging technological solutions to entrepreneurship; and
9. appreciate why ventures fail due to lack of planning and poor implementation.

Course Contents

Opportunity identification (sources of business opportunities in Nigeria, environmental scanning, demand and supply gap/unmet needs/market gaps/market research, unutilised resources, social and climate conditions and technology adoption gap). New business development (business planning, market research). Entrepreneurial finance (venture capital, equity finance, Micro finance, Personal savings, small business investment organizations and business plan competition). Entrepreneurial marketing and e-commerce (principles of marketing, customer acquisition & retention, B2B, C2C and B2C models of e-commerce, first mover advantage, Ecommerce business models and successful E-commerce companies,). Small business management/family business; leadership & management, basic book keeping, nature of family business and family business growth model; negotiation and business communication (Strategy and tactics of negotiation/bargaining, traditional and modern business communication methods). Opportunity discovery demonstrations (business idea generation presentations, business idea contest, brainstorming sessions, Idea pitching); technological solutions (the concept of market/customer solution, customer solution and emerging technologies, business applications of new technologies - Artificial Intelligence (AI), Virtual/Mixed Reality (VR), Internet of Things (IoTs), blockchain, cloud computing, renewable energy etc. Digital Business and E-commerce strategies).

PHY 301: Analytical Mechanics I (2 Units C: LH 30)

Learning Outcomes

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

1. explain and evaluate particle motion in one, two, and three dimensions;
2. describe the two-body problem and many body systems;
3. define and solve problems of conservative forces;
4. explain Newton theory of gravitation;
5. describe the nature of generalized motion;
6. explain the theory of relativity;

7. choose an appropriate set of generalized coordinates to describe a dynamical system and obtain its Lagrangian in terms of those coordinates and the associated 'velocities';
8. derive and solve the corresponding equations of motion. Treat small oscillations as an eigenvalue problem.

Course Contents

Review of Newtonian Mechanics. Motion of a particle in one, two and three dimensions. Internal forces. External forces. Forces of constraint. Systems of particles and collision theory. Newtonian gravitation; conservative forces and potentials, oscillations, central force problems; accelerated frames of reference. Rigid body dynamics. Rotational problems and space coordinates. Mechanics of continuous media. Galilean relativity. Relativistic kinematics and dynamics. Applications of relativistic kinematics.

PHY 303: Electromagnetism (3 Units C: LH 45)

Learning Outcomes

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

1. derive Maxwell's equation set from the empirical laws of electromagnetism;
2. use the fundamental laws of electromagnetism to solve simple problems of electrostatics, magnetostatics and electromagnetic induction in a vacuum;
3. modify Maxwell's laws to apply in the presence of materials and solve problems involving them;
4. derive the electromagnetic boundary conditions which apply at the interface between two simple media, and to use them to solve problems involving two or more materials;
5. explain the properties of plane electromagnetic waves in a vacuum and in simple media and to be able to derive these properties from Maxwell's equations;
6. apply the special theory of relativity to problems in electromagnetism.

Course Contents

Review of Vector calculus. Electrostatics and Magnetostatics. Magnetization and magnetic susceptibility. Laplace's equation and boundary value problems. Multipole expansions. EM waves in dielectric and magnetic materials. Polarization of EM waves. Electromagnetic induction. Faraday and Lenz’s laws. A.C. Circuits. Maxwell's equations. Lorentz covariance and special relativity. Gauss theorem in dielectrics. Poisson’s equations. Uniqueness theorem. Magnetic properties. Motors. Generators. Poynting vectors.

PHY 304: Electromagnetic Waves and Optics (3 Units C: LH 45)

Learning Outcomes

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

1. explain plane electromagnetic waves and waves propagation;
2. derive the wave equation;
3. describe the transport of electromagnetic energy;
4. explain scattering, interference, diffraction, reflection, polarization, and refraction of electromagnetic waves;

5. use complex notation competently for wave phenomena;
6. solve problems which require the use of wave representations of electric and magnetic fields in propagating electromagnetic waves;
7. analyse simple examples of interference and diffraction phenomena;
8. explain the principles of operation of a range of equipment used in modern optics, notably the Michelson interferometer and Fabry-Perot etalon; and
9. explain the physics of the laser and processes involved in producing laser radiation to solve simple problems.

Course Contents

Review of Maxwell's equations and wave equations in a dielectric. Electromagnetic potentials. Propagation of plane and spherical waves. Huygen's wavelets and Fermat's principle. Recap of polarization states. Interference. Michelson interferometer and Fabry-Perot etalon. Fourier transform spectroscopy. Young's slits. Lloyd's mirror. Fraunhofer diffraction. Resolution of optical instruments. Reflection and refraction. Transmission lines. Wave guides and optical cavities. Lasers (rate equation, Steady state operation; threshold and efficiency).

PHY 305: Quantum Physics (3 Units C: LH 45)

Learning Outcomes

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

1. explain the origin of quantum physics and principles of quantum theory;
2. apply the mathematical tools of quantum physics;
3. explain how quantum states are described by wave functions;
4. apply operators and solve eigenvalue problems in quantum mechanics;
5. solve the Schrodinger equation and describe the properties of the simple harmonic oscillator;
6. use the algebra of angular momentum operators and solve the simple eigenvalue problems of an angular momentum in quantum mechanics;
7. apply quantum mechanics to describe the hydrogen atom;
8. employ quantum mechanics to describe the properties of one-electron atoms;
9. use quantum mechanics to describe the simple multi-electron systems such as helium atom and hydrogen molecule.

Course Contents

Wave-particle duality and the uncertainty principle. Basic principles of the quantum theory. Time dependent Schrodinger equation. Energy levels and potential wells. Reflection and transmission of potential barriers. Operators and quantum states. Commutation relations and compatibility of different observables. Orbital angular momentum. Particle in two dimensions. Familiar wave phenomena and their associated wave equations. Physical interpretation of the wave function as a probability amplitude. Energy levels and stationary states. Energy bands in periodic lattice. Solution of Schrodinger equation for a central potential in three dimensions. The hydrogen atom. Multi-electron atoms. The harmonic oscillator. Exchange symmetry.

PHY 306: Statistical and thermal physics I (2 Units C: LH 30)

Learning Outcomes

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

1. describe an ideal gas on the basis of classical statistics;
2. explain the basic concepts of statistical mechanics, including entropy, its statistical interpretation and relation to disorder, and the statistical origin of the second law of thermodynamics;
3. illustrate the canonical and grand-canonical partition functions for systems in thermal equilibrium and use them to obtain thermodynamic quantities of interest;
4. describe the implications of the indistinguishability of particles for systems of non-interacting quantum particles;
5. deduce the Bose-Einstein and Fermi-Dirac distribution functions and apply them to calculate the properties of Bose and Fermi gases, for example in the context of white dwarf stars and black-body radiation; and
6. explain the physical origin of Bose-Einstein condensation, to characterize it quantitatively, and to explain the experiments confirming Bose-Einstein condensation.

Course Contents

Basic theory of thermodynamics. Basic of probability theory. Microstates and macro-states. The concept of ensembles. Statistical interpretation of entropy and temperature. Isolated systems and the microcanonical ensemble. Statistical physics of non-isolated systems. Derivation of the Boltzmann distribution and canonical ensemble. The partition function in thermodynamics. Noninteracting systems. Equipartition theorem. Density of states. Grand canonical ensemble. Fermi-Dirac and Bose-Einstein distributions. The ideal Fermi gasses. Fermi energy. Heat capacity. The ideal Bose gasses. Black body radiation. Bose-Einstein condensation.

PHY 307/308: Experimental Physics V & VI (2 Units C: PH 90)

Learning Outcomes

On completion, the students should be able to:

1. verify some equations, physical laws and theorems;
2. identify apparatus, design and set up experiments;
3. investigate relationships between physical quantities numerically and graphically;
4. prepare and present laboratory reports.

Course Contents

A year-long series of mini courses on important experimental techniques. Topics covered include electronics, optics, electricity, atomic, molecular nuclear and low temperature physics, statistics and data handling and scientific writing.

PHY 318/418: Semiconductor Devices (3 Units C: LH 45)

Learning Outcomes

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

1. explain the type, functionality, and operation of semiconductor devices;
2. distinguish between conductors, semiconductors, and insulators;

3. describe the crystal structure of representative semiconductor diodes and amplifying devices;
4. describe the operation of semiconducting devices in a circuit;
5. be familiar with semiconductor device packaging and symbol representations;
6. recognize the functional operation of diodes and amplifying semiconductor devices;
7. describe how to test semiconductor devices and evaluate their status;
8. describe forward and reverse bias characteristics of diodes;
9. explain voltage-current characteristics of semiconductor devices;
10. explain the physics and operation of the transistors;
11. describe metal - semiconductor junction characteristics;
12. explain the basics of FET's and MOSFET's structures; and
13. state the principle of operation of photonic devices.

Course Contents

Classes of semiconductor. The physics of semiconductors. Band structure of metals, semiconductors, and insulators. Semiconductor equilibrium. Doping and statistics. Carrier distribution, transport, and recombination. Carrier drift, diffusion, and conductivity. Hall effect. semiconductor growth. Semiconductor quantum structures. Modelling and application of selected semiconductor devices. P-n junction. Review of junction and bipolar transistor physics. Major emphasis on MOS devices including field effect transistors and charge coupled devices. Consideration of advanced bipolar structures. Schottky barrier devices. Optical properties of semiconductors (light emitting diodes and photo-detectors). Solar cells.

PHY 399: Industrial Attachment I (3 Units; C; 12 weeks)

Learning Outcomes

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

1. develop practical skills of the theories learned in the classroom;
2. acquire working experience of the industries;
3. handle relevant tools and equipment in the industries; and
4. write technical reports on their industrial work and present seminar.

Course Contents

Students should be attached to relevant organizations for 12 weeks at the 300 level preferably during the long vacation for industrial experience training. Students are to be assessed based on seminar presentation, technical reports, and assessment by supervisors.

BHU-PHY 309 Mobile Communication Systems (2 units; Elective; L=15; PH=45)

Senate-approved relevance

Mobile technology is technology that goes where the user goes. It consists of portable two-way communications devices, computing devices and the networking technology that connects them. Currently, mobile technology is typified by internet-enabled devices like smartphones, tablets and watches. These are the latest in a progression that includes two-way pagers, notebook computers, mobile telephones (flip phones), GPS-navigation devices and more. The communications networks that connect these devices are loosely termed wireless technologies. They enable mobile devices to share voice, data and applications (mobile apps). Through this course, the Bingham University's vision to produce knowledgeable and self-reliant graduates with the fear of God is achieved from skills necessary for personal communication services that provides a broad systems overview. It will provide the technical details for a clear understanding of the basic technology, architecture, and applications associated with mobile communications for effective use in an organization.

Overview

This course is well designed to enable the students comprehend how mobile communication has developed and/is developing the world, and how the world has become a global village because of internet-enabled devices. It analyses how mobile telecommunication evolved over time.

The course explores the evolution of mobile radio communications, from mobile radio and now to mobile phones. The Doppler effect and its applications in communication shall be discussed. Standards and overview of analogue and digital cellular systems; frequency management and channel assignment, speech coding, channel coding, bandwidth consideration and allocation, equalization, modulation techniques and applications of wireless communications will be studied. The objectives, learning outcomes and course contents for the course are provided in the foregoing section.

Objectives

The objectives of this course are to:

1. explain the evolution of mobile networks;
2. describe explain the basic cellular system and its characteristics and parameters;
3. state international standards and regulations;
4. describe the frequency management mechanisms;
5. enumerate field strength prediction models and their attributes;
6. outline frequency management and channel assignment; and
7. classify applications of wireless communications.

Learning Outcomes

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

1. state the five (5) evolution of mobile networks;
2. explain one (1) basic cellular system and its characteristics and parameters;
3. list five (5) international standards and regulations;
4. describe three (3) frequency management mechanisms;
5. discuss two (2) field strength prediction models and their attributes;
6. define frequency management and channel assignment;
7. list five (5) applications of wireless communications.

Course Contents

Evolution of mobile radio communications (1G, 2G, 3G, 4G and 5G). Examples of mobile radio systems (radio paging, cordless telephones, cellular radio). Trends in cellular radio and personal communication systems. A basic cellular system (frequency reuse, roaming, handoff strategies, co-channel interference, traffic and grade of service, system capacity, improving capacity of cellular system). Doppler effect. Co-channel interference and reduction. Standards and overview of analogue and digital cellular systems. Frequency management and channel assignment (channel coding, bandwidth consideration, equalization, modulation techniques, multiple, access techniques). GSM (architecture, elements, and standard interfaces) FDMA/TDMA structure. Speech and channel coding. Field strength prediction models. loss, multipath propagation problem, Rayleigh fading. Rician distribution. Other applications of wireless communications, especially in the financial sector.

BHU-PHY 311 Photovoltaic Design and Installation (3 units; core; L=30; PH=45)

Senate-approved relevance

The sun is the world's most abundant source of solar energy and is constantly available everywhere on the planet. Costs to install solar panels have significantly decreased. Installing solar panels now costs less than $3 per watt, a staggering 65% reduction from $8.50 per watt ten years ago. Increasingly solar energy is being captured by new technology. This course in line with the Bingham University's vision to produce knowledgeable and self-reliant graduates with the fear of God equips students with the latest knowledge on how to install, maintain and repair solar photovoltaic equipment and understand the theory behind solar power. This course will enable Bingham University graduates work successfully in the renewable and solar energy industry, both locally and internationally.

Overview

Solar electricity, also known as photovoltaics (PV), has shown since the 1970s that the human race can get a substantial portion of its electrical power without burning fossil fuels (coal, oil or natural gas) or creating nuclear fission reactions. Photovoltaics helps us avoid most of the threats associated with our present techniques of electricity production and also has many other benefits. Photovoltaics has shown that it can generate electricity for the human race for a wide range of applications, scales, climates, and geographic locations.

The course is focused on electric power generation through solar PV technology. The course starts with the essence of solar PV power generation. It is followed by various aspects of system specification, design, project implementation and operation & maintenance. The different types of for standalone and grid distribution are discussed. The course offers a blend of technical expertise required for design and operation of a solar PV power system and the understanding of the maintenance of the system. The objectives, learning outcomes and course contents for the course are provided in the foregoing section.

Objectives:

The objectives of this course are to:

1. develop a comprehensive of the advantages and disadvantages of PV systems compared to alternative electricity generation sources;
2. evaluate the design priorities for different types of photovoltaic applications;
3. identify the relationship between photovoltaic cells, modules and arrays;
4. describe the photovoltaic effect;
5. explain the current voltage/voltage characteristics for a photovoltaic cell/panel;
6. demonstrate and design how series/panels are connected in series to achieve the desired voltage and current;
7. determine how the azimuth angle of an array affects its energy output;

8. define the primary function of an inverter, charge controller and battery;
9. explain the purpose and basic functioning of bypass diodes; and
10. describe the features and benefits of PV systems that operate independently of the electric utility grid.

Learning Outcomes

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

1. list five (5) advantages and disadvantages of PV systems compared to alternative electricity generation sources;
2. evaluate the design priorities for three (3) different types of photovoltaic applications;
3. identify two (2) the relationship between photovoltaic cells, modules and arrays;
4. define the photovoltaic effect;
5. draw and label the current voltage/voltage characteristics for a photovoltaic cell/panel;
6. demonstrate and design how three (3) series/panels are connected in series to achieve the desired voltage and current;
7. determine how the azimuth angle of an array affects its energy output;
8. define the primary function of an inverter, charge controller and battery;
9. explain two (2) purpose and basic functioning of bypass diodes; and
10. enumerate five (5) the features and benefits of PV systems that operate independently of the electric utility grid;

Course Contents

Introduction to Solar Photovoltaics and Energy Efficiency. Basic theory of a photovoltaic system. Global solar PV deployment status. Solar radiation components. PV module technology (c-Si, Thin-film, Amorphous-Si and Emerging solar cells). Fundamental properties of semiconductors**.** Inverter technologies (types, selection, voltage levels, performance and power quality). Balance of system (Module mounting structure, tracking system, Cabling and electrical design, single line diagrams, metering). Battery technologies (standalone system and utility scale storage). Types of PV systems (Design considerations for standalone and grid connected plants, rooftop and ground mounted, floating solar plant, BIPV). Performance parameter (Losses in solar PV power plant, Yield, Capacity utilization factor and Performance ratio). Operation and maintenance. Fundamental Properties of Semiconductors. *PN* -Junction Diode Electrostatics. Theoretical Limits of Photovoltaic Conversion. Crystalline Silicon Solar Cells and Modules. Thin-film and Amorphous Silicon Solar Cells.

400 Level

PHY 401: Quantum Mechanics I (3 Units C: LH 45)

Learning Outcomes

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

1. state the postulates of quantum mechanics;
2. explain the basics of vectors and tensor operators;
3. solve a variety of physical problems using the Schrodinger equation;
4. work with angular momentum operators and their eigenvalues both qualitatively and quantitatively;

5. explain electron spin and the Pauli principle; and
6. apply perturbation theory and other methods to find approximate solutions to problems in quantum mechanics, including the fine-structure of energy levels of hydrogen.

Course Contents

The formulation of quantum mechanics in terms of state vectors and linear operators. Time evolution of the Schrodinger equation. The theory of angular momentum and spin. Electron spin and the Stern-Gerlach experiment. Identical particles and the Pauli exclusion principle. Multielectron atoms. Approximation methods. Variational methods and WKB approximation for bound states and tunnelling. Time - independent perturbation theory. The fine structure of hydrogen. Harmonic oscillator. Creation and annihilation operators.
External fields. Zeeman and Stark effects in hydrogen.

PHY 402/502: Quantum Mechanics II (3 Units C: LH 45)

Learning Outcomes

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

1. apply the mathematical tools of quantum mechanics;
2. recognise approximation methods in quantum mechanics;
3. explain the scattering theory;
4. identify the unitary transformations linked to symmetry operations;
5. apply time-dependent perturbation theory to variety of problems;
6. derive a mathematical description of quantum motion in electromagnetic fields;
7. apply the relativistic wave equations to simple single-particle problems; and
8. use Dirac notation to represent quantum-mechanical states and manipulate operators in terms of their matrix elements.

Course Contents

Time-independent and time-dependent perturbation theory. Scattering theory. Elastic potential scattering. Green's function and partial wave methods. Symmetries in quantum mechanics. Rotations, space-time reflections and parity. Selection rules for atomic transitions. Emission and absorption of radiation. Selection rules for hydrogen. Description and interpretation of selected phenomena from each of atomic physics, molecular physics, solid-state physics, and nuclear physics using quantum mechanical models. Relativistic wave equation. The Klein-Gordon equation. The Dirac equation.
Chirality. Lorentz invariance and non-relativistic limit.

PHY 403: Mathematical Methods for Physics I: (3 Units C: LH 45)

Learning Outcomes

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

1. explain the concepts of scalar and vector fields;
2. describe the properties of div, grad and curl and be able to calculate the divergence and curl of vector fields in various coordinate systems;
3. calculate surface and volume integrals in various coordinate systems;
4. calculate flux integrals and relate them to the divergence and the divergence theorem;

5. calculate line integrals and relate them to the curl and to Stokes' theorem;
6. apply the methods of vector calculus to physical problems; and
7. calculate the Fourier series associated with simple functions and apply them to selected physical problems.

Course Contents
Vector and scalar fields. Vector operators. Div, grad, and curl. Divergence theorem. Stoke's theorem. Linear Algebra and functional Analysis. Transformations in linear vector spaces and matrix theory. Hilbert space and complete sets of orthogonal functions. Special functions of mathematical physics (The gamma function; hypergeometric functions; Legendre functions; Bessel functions. Hermite and Laguerre functions. The Dirac - Delta function. Integral transforms and Fourier series. Fourier series and Fourier transforms. The Dirichlet conditions. Orthogonality of functions. Fourier coefficients. Complex representation of Fourier series. Laplace transforms. Applications of transform methods to the solution of elementary differential equations of interest
in physics and engineering.

PHY 404: Mathematical Methods for Physics II (3 Units C: LH 45)

Learning Outcomes
At the end of the course, students should be able to:
1. describe the properties of different types of functions and be able to sketch them in both 2D Cartesian and polar coordinates;
2. integrate and differentiate functions of one variable using a range of techniques and be able to apply integration and differentiation to a range of physical problems;
3. show how smooth functions can be expressed in terms of power series;
4. explain the properties of complex numbers and construct some basic complex functions;
5. employ matrix notation, carry out matrix algebra and use matrices to solve systems of linear equations;
6. compute the properties of determinants, be able to evaluate them, and use them to test for unique solutions of linear equations; and
7. solve first and second order ordinary differential equations using a range of techniques.

Course Contents
Partial differential equations. Solution of boundary value problems of partial differential equations by various methods which include separation of variables, the method of integral transforms. Sturm-Liouville theory; uniqueness of solutions. Calculus of residues and applications to evaluation of integrals and summation of series. Applications to various physical situations, which may include, electromagnetic theory, quantum theory, diffusion phenomena; complex variable theory and their relation to selected physical problems. Complex differentiation and integration. Cauchy's theorem. Taylor's and Laurent's series. Ordinary differential equations of first and second order and their and their physical applications. Homogeneous partial differential equations.

PHY 405: Physics Entrepreneurship (2 Units C: LH 15; PH 45)

Learning Outcomes

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

1. develop creative ability to apply physics knowledge to real-world settings;
2. generate ideas of innovation and entrepreneurship; and
3. apply entrepreneurial skills and mindset in approaching societal problems.

Course Contents

Creativity. Developing questioning attitude. Concept development. Reconstructionism. Critical thinking and brainstorming. Use of practical and creative techniques in concept development. Identifying underlining physics principles in real life situations and physics principles driving equipment design. Product development and requirements. Team building. Product and service design concepts. Consumer driven design. Business planning. Marketing and market research. Intellectual property. Pricing and financial strategies. Finding sources of funding.

BHU-PHY 406 Renewable Energy Systems and Technology (2 units; Elective; L=15; PH=45)

Senate-approved relevance

The global energy challenge has necessitated the transition from traditional fossil fuels to renewable and cleaner energy sources. Renewable Energy Systems and Technology will address the three main issues involved in the global energy challenge: meeting the rising demand, considerations for the environment and lowering the cost of production. The focus of this course in line with Bingham University's vision and mission to produce knowledgeable and self-reliant graduates with the fear of God is to prepare students as global citizens and potential policy makers that benefit from being exposed to the topical issue of sustainable generation of energy captured in the sustainable development goal number 7 – "Access to affordable, reliable, sustainable, and modern energy for all" and goal number 13 – "Taking urgent action to combat climate change and its impacts".

Overview

Students are introduced to different types of renewable energy resources by engaging in various activities to help them understand the transformation of energy (solar, water, nuclear, biomass, geothermal and wind) into electricity. Topical issues such as environmental sustainability, climate change, green economy and eco-friendly technologies are discussed within a scientific framework.

The course explores the current and potential future energy systems in Nigeria and globally (resources and extraction). Concepts in energy conversion systems and the parallels and differences in various conversion systems are dealt with. The end-use energy technologies with emphasis on meeting 21st-century national, regional and global energy needs in a sustainable manner. Various energy technologies in each fuel cycle stage for fossil (oil, gas, synthetic), nuclear (fission and fusion) and renewable (solar, biomass, wind, hydro, and geothermal) are studied in the middle of the course. The course finally focusses on renewable energy and its sustainability in relating to economic development and environmental impact. The objectives, learning outcomes and course contents for the course are provided in the foregoing section.

Objectives
The objectives of this course are to:

1. identify the types, uses and advantages of renewable energy in relation to climate change;
2. evaluate the use of the various renewable energy systems;
3. recognize and analyse the current energy systems in Nigeria, their impacts on development and the global energy demand and supply scenarios;
4. appreciate the environmental impact of energy exploitation and utilization, and pursue the sustainable development of renewable energy for various applications;
5. recognize the exploitation, excavation, production, and processing of fossil fuels such as coal, petroleum and natural gas, and discuss the sources, technology and contribution to future energy demands of renewable energy;
6. explain sustainability of energy;
7. explain types, storage, transmission and conservation of energy;
8. enumerate the parallels and differences in various conversion systems; and
9. describe the end-use energy technologies with emphasis on meeting 21st-century energy needs.

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

1. identify five (5) types, uses and advantages of renewable energy in relation to climate change;
2. demonstrate one (1) design for use in the various renewable energy systems;
3. list five (5) current energy systems in Nigeria, their impacts on development and the global energy demand and supply scenarios;
4. list five (5) environmental impact of energy exploitation and utilization, and pursue the sustainable development of renewable energy for various applications;
5. explain the exploitation, excavation, production, and processing of two (2) fossil fuels such as coal, petroleum and natural gas, and discuss the sources, technology and contribution to future energy demands of renewable energy;
6. define sustainability of energy;
7. list two (2) types of energy transmission and conservation;
8. list five (5) parallels and differences in various conversion systems; and
9. describe two (2) of the end-use energy technologies with emphasis on meeting 21st-century energy needs.

Course Contents
Current and potential future energy systems in Nigeria and globally (resources and extraction). Concepts in energy conversion systems. Parallels and differences in various conversion systems. End-use energy technologies with emphasis on meeting 21st-century national, regional and global energy needs in a sustainable manner. Various energy technologies in each fuel cycle stage for fossil (oil, gas, synthetic). Nuclear (fission and fusion). Renewable (solar, biomass, wind, hydro, and geothermal). Energy types. Energy storage. Energy transmission. Energy conservation. Analysis of energy mixes within an engineering, economic and social context. Sustainable energy. Sustainability and in the overall concept of sustainable development. Sustainable energy as the

fundamental benefit of renewable energy. Simple measurement of solar radiation, bomb calorimeter determination of calorific value of fuels and biomass.

BHU-PHY 407 Electronics I (2 units; Core; L = 30)

Senate-approved relevance

Electronics is fantastic to study because you are always working with and learning about the latest advances; always on the cutting edge of technology. It is a mix of mathematics and science but give the creative freedom to use and apply the theory and make something new. This course will prepare Bingham graduates to acquire skills in the construction and working of electronic devices and circuits, fields of semiconductor and manufacturing, industrial electronics, robotics, system analysis and the fundamentals of communication systems. Thereby fulfilling the vision and mission Bingham University to produce knowledgeable and self-reliant graduates with the fear of God as they contribute to increasing the sophistication and miniaturization of electronic components in the world of technology.

Overview

This course develops in students an enquiring attitude towards the electronics universe which abounds and with which they interact every single day. Communications are made with convenience with electronic gadgets like phones and computers. Learning at all ages is also made easier with learning apps using electronic devices.

The course introduces students to the classes of amplifiers and explains the equivalent circuits of transistors. Hybrid equivalent model and the operating points of transistors are discussed. Other topics discussed are bias stability, oscillators, negative and positive feedbacks, LC and RC oscillators, power supply, rectifiers, operational amplifiers, and regulation of voltage output. The objectives, learning outcomes and course contents for the course are provided in the foregoing section.

Objectives

The objectives of this course are to:

1. define an Amplifier and understand the basic components of an Amplifier;
2. analyze the operations and the applications of the various classes of an Amplifier;
3. describe the operations of a Bipolar Junction Transistor (BJT);
4. define the h-parameters;
5. identify the various operation points of a linear device (BJT) and the associated characteristics;
6. evaluate the concept of feedback and the types of feedbacks;
7. appraise the concept of feedback;
8. identify and describe the rectifier circuits;
9. define and identify operational amplifiers; and
10. define the various type of voltage regulator ICs and their respective functions.

Learning Outcomes

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

1. define an Amplifier and list five (5) basic components of an Amplifier;

2. understand the operations and the applications of the four (4) classes of an Amplifier;
3. understand the operations of the three (3) Bipolar Junction Transistor (BJT);
4. define the h-parameters;
5. identify the two (2) operation points of a linear device (BJT) and the associated characteristics;
6. list the two (2) types of feedbacks;
7. sketch and explain the two (2) types of feedback;
8. list two (2) properties of voltage regulators and the effect in a dc supply unit;
9. identify four (4) operational amplifiers; and
10. list two (2) of voltage regulator ICs and their respective functions.

Course Contents

Amplifiers. The Equivalent Circuits of Transistors. Hybrid Equivalent Model. Operating Point. Bias stability. Oscillators. Negative Feedback. Positive Feedback. The principles and the functioning of LC and RC Oscillators. Power supply. Power Sources. DC Power Rectifiers. Filter Circuits. Linear Integrated Circuits. Operational Amplifiers (OpAmps). Applications of Operational Amplifiers. Regulation of Output Voltage.

BHU-PHY 408 Introduction to Nuclear and Particle Physics (2 units; Core; L = 30)

Senate-approved relevance

Research in nuclear and physics has been providing technological advances that benefit society, contributing in many ways to health, energy production and security worldwide. Exposing Bingham University students to the peaceful use of the knowledge of nuclear physics is in line with the University's philosophy of raising morally and ethically upright citizens in the fear of God that are equipped with the scientific and technological skills to provide solutions to some of Nigeria's economic and technological challenges especially in the area of power generation and food preservation.

Overview

This is an introductory course on the foundations of nuclear and particle physics, including the fundamental forces and particles, nuclear structure, forces, reaction, reactor and energy. Emphasis is on current researches devoted to producing a controlled, rather than an explosive, fusion device, which would be less radioactive than a fission reactor and would provide an almost limitless source of energy.

The course covers the basic concepts of nuclear physics with emphasis on nuclear structure, composition and mechanism of harnessing the huge energy. Peaceful applications of the energy for human development especially in producing clean and affordable energy in line with the MDGs. The major concerns for safety and security in nuclear enterprise would also be discussed with safeguard measures usually put in place to mitigate threats, prevent nuclear accidents and circumvent disasters in nuclear facilities. The objectives, learning outcomes and course contents for the course are provided in the foregoing section.

Objectives

The objectives of this course are to:

1. describe different nuclear physics applications in science and technology;
2. calculate energy released in nuclear fusion and fission reactions;
3. list advantages of fusion over fission;
4. describe the principles of operation of a nuclear reactor;
5. recognize criticality as a condition for steady state operation of a reactor;
6. perform basic nuclear experiments, measurements and interpret the results;
7. apply general concepts of quantum physics to atomic and nuclear systems; and
8. analyze the production of fundamental particles in particle accelerators.

Learning Outcomes

After successfully completing the course, the student should be able to:

1. describe five (5) different nuclear physics applications in science and technology;
2. calculate energy released in two (2) nuclear fusion and fission reactions;
3. list two (2) advantages of fusion over fission;
4. describe the principles of operation of one (1) type of nuclear reactor;
5. recognize criticality as one (1) condition for steady state operation of a reactor;
6. perform two (2) basic nuclear experiments, measurements and interpret the results;
7. apply two (2) general concepts of quantum physics to atomic and nuclear systems; and
8. analyze the production of three (3) fundamental particles in particle accelerators.

Course Contents

Role and importance of nuclear energy. Principles of unlocking the huge energy locked up inside the nucleus. Basic concepts (nuclides, isotopes, nuclear chart, nuclear mass, binding energy and stability, radioactive decays and nuclear reactions). Nuclear stability and radioactive decay. Calculation of binding energy and mass defect. Types of interaction of nuclear radiations with matter. The probabilistic interactions of neutrons with matter (scattering, cross-sections, attenuation, flux, cross-section data). Energy loss in scattering collision. Mechanism of nuclear fission and chain reaction. Principle of operation of a nuclear reactor. Critical mass and chain reaction. Fuel enrichment. Controlling the reactions (Neutron moderation & attenuation and use of control rods). Mechanism of energy transfer. Essential components of a reactor. The future breeder reactors. Fundamental particles in particle accelerators. Nuclear Security & Safety.

BHU-PHY 409 Research Methodology & Presentation Skills (2 units; Core; L=30)

Senate-approved relevance

Effective communication of undergraduate students' research findings and proper dissemination of the results in a way accessible to the end users is predicated on mastery of presentation skills. This course aligns with some of Bingham University's cardinal academic principles of encouraging students to think logically and creatively, undertake problem identification, analysis and proffer solution. The vision of Bingham University to make our graduates knowledgeable and self-reliant in the fear of God requires continued learning throughout life in order to keep up and adapt to a rapidly changing global technological environment would also be realized through this course. It is well known fact that the quality and credibility of any research work is subject to appropriateness of the research methods and materials used. Attempt to adequately prepare the students to meet these two requirements for a successful and impactful research work culminated in developing this course on research methodology and presentation skills. The focus of the course is equipping Bingham University's graduates with all the skills needed from choosing research topic to search for relevant literature to choosing appropriate experimental design with feasible and up-to-date techniques, to implementation and publications and presentations of results. The skills to be acquired will be very useful in seminar presentation and project defence.

Overview

Undergraduate studies usually culminate in independent research project with two major grading components: written work and oral presentation/defence. Well-crafted, excellently delivered, thought-provoking presentation requires special skills not often found in the mainstream science curriculum. The course is therefore designed to equip Physics graduates with the skills needed to make them competent in conducting research, preparing their reports and presenting these results with confidence.

The course is designed to teach scientific method to budding scientists and also provide step by step guide to communicating scientific ideas to different target audiences (both science and non-science) in the most appropriate, accessible, compelling and effective manner. The objectives, learning outcomes and course contents for the course are provided in the foregoing section.

Objectives

The objectives of this course are to:

1. describe using the scientific method to solve problems;
2. explain how to write report and make good presentations;
3. explain plagiarism;
4. review literature relevant to their interest;
5. carry out independent research;
6. analyze and interpret data to provide valid conclusions;
7. write scientific report;
8. publish and present scientific report; and
9. explore various styles or format for referencing/citation for a number of commonly used research sources.

Learning Outcomes

Upon completion of the course the students should be able to:

1. apply the scientific method to solving two (2) problems generally and in Physics in particular;
2. display two (2) presentation skills with clear exhibition of communication prowess, good appearance and mastery of the subject matter;
3. demonstrate knowledge and understanding of two (2) experimental research designs;
4. search and review literature fifty (50) papers/articles relevant to their interest;
5. carry out one (1) independent research;
6. analyze and interpret five (5) sets of data to provide valid conclusions;
7. write one (1) scientific report;
8. present one (1) scientific report; and
9. reference two (10) research papers/articles in books/conference proceedings.

Course contents

Introduction to research methodology. Review of common pitfalls in writing. Principles of clear writing. Literature review. Journal search. Skills for writing of their project/thesis /dissertation work. Online research. Referencing styles. Graphical and visual effects for presentation. Organization of reports. Power point presentation. Choosing research topics. Proposals for projects and research. Research reports. Formats of reports and presentation. Independent research. Experimental research. Scientific writing.

BHU-PHY 411 Computational Physics (2 units; Core; L=15; PH=45)

Senate-approved relevance

This course aims to train the students in solving problems sometimes encountered in Science and Engineering in which there are sometimes no analytical solutions. Numerical, approximate solutions become an alternative. This course aligns with some of Bingham University's cardinal academic principles of encouraging students to think logically, creatively, inventively, and to undertake problem identification, analysis and proffer novel solution to a long-standing problem. This will give Bingham University graduate an edge in the competitive global world. In furtherance with its mission and vision the course is designed to teach the students about numerical methods and their theoretical bases hence inculcating in the students the skill to apply various techniques in computation analysis in solving real life physical problems in complex systems. Bingham graduates will therefore be versatile in the use of contemporary scientific programming languages and application software such as Python/Mat lab software and electronic spreadsheet.

Overview

Computational physics is the study of scientific problems using computational methods. It combines computer science, physics and applied mathematics to develop scientific solutions to complex problems some of which have no analytical or conventional solutions. Computational physics complements the areas of theory and experimentation in traditional scientific investigation.

This course covers topics in numerical methods of integration and differentiation and their solutions, polynomial, interpolation, least squares and curve fitting, approximations and iterative methods, statistical analysis of experimental data and the use of Python/Mat lab software and electronic spreadsheet. The objectives, learning outcomes and course contents for the course are provided in the foregoing section.

Objectives

The objectives of this course are to:

1. solve physical problems using computational analysis;
2. solve problems with numerical integration and differentiation;
3. analyze non-linear algebraic equations computationally;
4. use iterative methods to solve problems;
5. determine the approximations in the analysis of problems;
6. use computational methods to factorize;
7. solve problems using Python/Mat lab software;
8. calculate the positive root of a quadratic equation to a specified number of significant figures using Newton-Raphson's method; and
9. compute the regression analysis assuming a linear relationship between two quantities Y and X and determine the equation of the regression line of Y on X.

Learning Outcomes

After successfully completing the course, the student should be able to:

1. solve five (5) physical problems using computational analysis;
2. solve ten (10) problems with numerical integration and differentiation;
3. analyze four (4) non-linear algebraic equations computationally;
4. use two (2) iterative methods to solve problems;
5. compute two (2) approximations in the analysis of problems;
6. solve four (4) problems using Python/Mat lab software;
7. calculate two (2) roots of a quadratic equation to a specified number of significant figures using Newton-Raphson's method;
8. compute two (2) regression analysis assuming a linear relationship between two quantities Y and X and determine the equation of the regression line of Y on X;
9. Compute two (2) regression analysis assuming a linear relationship between two quantities Y and X and determine the equation of the regression line of Y on X.

Course Contents

Use of numerical methods in Physics. Numerical integration. Differentiation. Applications of numerical solutions to differential equations in Physics. Statistical analysis of experimental data. Numerical solution of non-linear algebraic equations. Polynomials. Zeros of polynomial. Numerical solution of systems of linear algebraic equations. Interpolation. Least squares and curve fitting. Trapezoidal and Simpson' approximations. Bracketing and iteration methods and its applications as multiple root methods. Direct solution of the system of linear equations. Gauss-elimination. Direct and indirect factorization. Iterative methods. Numerical solution of initial value problems. Single-Step methods like Euler's method. Euler's modified method. Runge-Kutta method. Taylor's series expansion.

Definition of Terminologies and Concepts Contained in the Programme

The Department of Physics of the Bingham University Karu runs a two-semester programme in an academic session based on the course credit system. A semester is expected to last for upwards of 16 weeks in which 14 weeks must be dedicated lectures. The salient points to be noted: No student may be required to repeat a whole year in any course level. A student shall only repeat course failed at any given level. Academic work in the Faculty of Sciences is organized in concentrated modules of subject materials referred to as courses. Each course is planned as a complete unit of study with a scheduled period of instructional/contact hours each semester.

Course System

This should be understood to mean a quantitative system of organization of the curriculum in which subject areas are broken down into unit courses which are examinable and for which students earn credit(s) if passed. The courses are arranged in progressive order of complexity or in levels of academic progress. For example, 100 Level or year 1 courses are 100, 101 etc. and 200 Level or year 2 courses are 200, 202; and so on for levels 3 and 4.

The second aspect of the system is that courses are assigned weights allied to units. Units consist of specified number of student-teacher contact hours per week per semester. Units are used in two complementary ways: one, as a measure of course weighting, and the other, as an indicator of student work load. The minimum number of credit units for the award of a degree is subject to the usual Department and Faculty requirements. A student shall therefore qualify for the award of a degree when he has met the required conditions. The minimum credit load allowed per semester is 15 credit units and the maximum is 24.

Course
A course is a subject of study consisting of only one syllabus, lasting one semester and associated with a single or two examination paper(s) and as per need, a course may last for more than one semester, provided that such a course is divided into two parts, either part of which carries equal credit weighting and last for only one semester and is examinable at the end of the semester.

Credit Units
Credit units refers to the weights attached to a course. One credit is equivalent to one hour per week per semester of 16 weeks of lectures or three hours of lecture/laboratory session per week per semester of 16 weeks.

Core/Compulsory Course
A course which every student must compulsorily take and pass in any particular programme at a particular level of study. They are central to the course of study. They must be taken and passed by the student before he/she will be deemed to have fully satisfied the conditions for successful completion of the programme. These are courses which are important for each programme without which the student cannot be awarded the requisite degree.

Elective Course
A course that students take within or outside the faculty. This is chosen by the student from a course list provided by the various departments for each semester. An elective may be taken along with the core courses to broaden the intellectual base and interdisciplinary perception of the students so long as the maximum credit for that session had not been exceeded. Students may graduate without passing the course provided the minimum credit units for the course required for graduation has been attained. This group of courses accounts for approximately 1-15% of the total weighting of the programme. This should constitute a set of courses from which a student can make a selection and should account for approximately 10% - 15% of the total weighting of the programme.

Laboratory
This is the name given to experimental laboratory sessions.

Continuous Assessment
Continuous assessment is a method of periodic assessment for students so as to assess the level of comprehension of the students and also to reduce the dependence of the total grade of the course on the end of course examinations. It normally contributes to the maximum 100% of the total course mark for each of the theory-based courses.

Pre-requisite Course
A course which student must take and pass before taking a particular course at a higher level. For example, PHY 305 is a per-requisite course to PHY 401.

General Course
A mandatory course, common to all students, that is taken at different levels of study and must be passed before graduation

Semester Course Credit Load for Students

A student shall register according to the programme prescribed by the department. This will comprise a minimum load of 24 credit unit and a maximum of 48 credits per session.

Grade Point Average (GPA) and Cumulative Grade Point Average (CGPA)

A system of Grade Point Average (GPA) and Cumulative Grade point Average (CGPA) is currently in use in the Nigerian University system. Grade Point Average and Cumulative Grade Point Average are calculated as numerical representations of a student's quality of performance. These averages are used to determine if a student qualifies for certain academic actions (e.g., probation, promotion, graduation and class of degree).

A student's Grade Point Average (GPA) is the weighted mean value of all grade points earned through examinations and other forms of formal assessment in a particular academic semester/session. While the Cumulative Grade Point Average (CGPA) is the weighted mean value of all the Grade Point Averages earned since enrolment on the particular programme. The table below shows how to calculate the GPA.

Grade Point Average (GPA) Calculation

Course	**Credit Units Registered (CUR)**	**Grade**	**Grade Point (GP)**	**Credit Units Earned (CUE)**	**CUR x GP = Weighted Grade Point (WGP)**	
C1	6	C	3	6	18	
C2	4	A	5	4	20	
C3	4	F	0	0	0	
C4	3	B	4	3	12	
C5	2	E	1	2	2	
C6	2	D	2	2	4	
C7	1	A	5	1	5	
C8	1	C	3	1	3	
	Total credit units registered			Total credit units earned	Weighted Grade Point (WGP)	Grade Point Average (GPA)=

						WGP ÷CUR
	23			**19**	**64**	64÷23=
						2.78

The more carry overs a student has, the larger the sum of the total credit units registered becomes and this lowers the value of the student's CGPA. The carry overs a student does not register or pass, will continue to reflect in the remarks page of the results page until the student registers and pass them. Compulsory courses not registered by students appears as on the remark page but this does not mean the course is a carry over for the student.

SIWES Rating and Assessment

Students will be exposed to a combination of field and industrial experiences in the public and private sectors Physics. Supervised Student Industrial Work Experience Scheme (SIWES) in addition to laboratory training shall be undertaken in an approved establishment for twelve (12) weeks. The students are expected to submit their log-books for assessment at the end of the training period. They are to write a report of the training experience and also make presentations to a panel of the staff of the Department and Faculty, and representatives from the Offices of the SIWES director and the Vice Chancellor. Students with an unsatisfactory performance shall be required to repeat the training programme.

Grading System for the Course

As an integral part of the course credit system, courses taken by students will be evaluated based on the following criteria:

1. Course relevance
2. Adequacy in terms of time and content coverage
3. Students understanding of the course materials
4. Adequacy of teaching, tutorials and practical sessions
5. Instructor's evaluation

The evaluation is aimed at improving the efficiency of course delivery by offering timely feedback to the course lecturers/instructors. A grade comprising a percentage score and a corresponding letter grade is awarded to each student at the end of the semester. These grades will include the results of both formative and summative assessments conducted when the course was taught. The range of percentage scores, grade letters and numerical grade point equivalents are given in the table below.

Score (%)	Grade Letter	Grade Point
70 - 100	A	5
60 – 69	B	4
50 – 59	C	3
45 – 49	D	2
40 – 44	E	1
0 - 39	F	0

Probation
A student shall be placed on academic probation if at the end of the second semester of an academic year the student scored less than 1.0 Cumulative Grade Point Average (CGPA).

Withdrawal
A student shall be requested to withdraw from a particular programme if at the end of a probation period, the student still does not make satisfactory progress. Such student shall be at liberty to apply for a change of programme within the university.

Degree classifications
The class of degree to be awarded will depend on the Cumulative Grade Point Average (CGPA) obtained. The following classes of degree based on CGPA are applicable.

Class of Degree	**Cumulative Grade Point Average**
First Class Honours	4.50-5.00
Second Class Honours (Upper Division)	3.50-4.49
Second Class Honours (Lower Division)	2.40-3.49
Third Class	1.50-2.39
Pass	1.00-1.49
Fail	0.00-0.99

Examination and Continuous Assessment

The primary goal of assessment is to improve the overall quality of learning as well as evaluate the quality of instruction. Different types of evaluation methods are adopted through the semester for all courses offered in the Physics programme which include but are not limited to: Oral presentations, laboratory exercises, SIWES report evaluations, Continuous assessment, research projects, quizzes and end of semester examinations.

Examination Regulations

1. Only students who have been duly admitted, registered, matriculated, paid their school fees in full, undergone a regular course of study in the University in line with the rules and regulations of the university and have attained a minimum class attendance of 70% shall be allowed to take their examinations.
2. Candidates must display their current University Identity cards during each examination.
3. Candidates must attend punctually at the times assigned to their papers, and must be at the venue of the examination thirty (30) minutes before the time the examination is due to start. She/he must be ready to be admitted into the examination hall, at least, ten (10) minutes before the time appointed for the commencement of the examination. Candidates should, therefore, refrain from studying in halls and lecture rooms earmarked for examinations. Candidates arriving more than half an hour after the examination has started shall not be allowed to participate in the examination, or may be admitted only at the discretion of the Chief Invigilator (i.e., provided the cause(s) of lateness by the student are reasonable, cogent and sufficiently convincing).
4. Similarly, except with the special permission of the Chief Invigilator, candidates may not leave the examination hall during the first and last half hour of the examination. Outside

those periods, candidates, with the permission of the Invigilator, may leave the room temporarily, and then only if accompanied by an invigilator.

5. Candidates must bring with them to the examination hall their own ink, pens and pencils and any materials which may be permitted by these regulations (see below), but they are not allowed to bring any other books or papers. Candidates are warned, in their own interest, to ensure that lecture notes, textbooks, bags, mobile telephones, etc. are not brought into the examination hall.
6. Candidates may be searched by the Invigilator before they are allowed into the examination hall.
7. While the examination is in progress, communication between candidates is strictly forbidden, and any candidate found to be giving or receiving irregular assistance may be required to withdraw from the examination.
8. Silence must be observed in the examination hall. The only permissible way of attracting the attention of the invigilator is by the candidate raising his/her hand for recognition.
9. The use of scrap paper is not permitted. All rough work must be done in the answer booklet and crossed neatly through. Supplementary answer sheets, even if they contain only rough work, must be tied to the main answer booklet.
10. Candidates are advised, in their own interest, to write legibly and to avoid using faint ink. Answers must be written in English, except as otherwise instructed. The answers to each question must start on a fresh page of the answer booklet.
11. Before handing in their answer scripts at the end of the examination, candidates must satisfy themselves that they have inserted at the appropriate places, their Matriculation Numbers and the numbers of the questions they answered.
12. It will be the responsibility of each candidate to hand in his/her script to the Invigilator before he/she leaves the hall. Except for the question paper, and any materials he/she has brought with him/her, the candidate is not allowed to remove or mutilate any paper or material supplied by the University.
13. Examination answer scripts/sheets whether used or unused should not be taken out of the examination hall by students.
14. Candidates must adhere strictly to the sitting arrangement made by the Chief Invigilator.

Forms of Malpractice

The following lists but is not limited to what is considered to be malpractice:

1. Impersonation
2. Plagiarism
3. Falsifying academic records
4. Falsifying medical records
5. Re-submission of used materials
6. Soliciting for marks
7. Refusal to fill malpractice form
8. Unauthorized communication
9. Un-authorised change of seating location
10. Illegal possession of exam materials
11. Possession of unapproved written material
12. Passing un-authorised materials to others
13. Aiding and abetting others to copy

14. Disobeying exam instructions

Procedure for handling Misconduct in the Examination Hall

Examination misconduct can occur during examinations or be observed by the Lecturer in the course of marking examination scripts. When such a situation arises:

1. The invigilator or Lecturer, who caught the student in action shall apprehend the student and make him/her fill and sign the examination misconduct report form on the circumstance that leads to his/her apprehension; the invigilator, examination attendant or the security officer should sign as a witness and submit to the Chief Invigilator.
2. The student(s) shall be allowed to finish his/her examination as soon as the documentation of his/her alleged offence is completed; he/she shall be given a fresh question paper and booklet to continue.
3. The answer script(s) containing the infringement and all other material evidence shall be collected, acknowledged and initialled by the student(s)
4. Where an examiner notices any irregularity during the marking of scripts, she/he shall report in writing. In both cases, the invigilator/examiner is required to complete the prescribed forms provided by the Examinations Officer. The form and a covering memorandum, the student(s) answer script(s), a written statement by the student(s) involved (where the suspect(s) is/are apprehended in the course of the examination), and other relevant documents or materials shall be forwarded through the Head of Department and the Dean to the Examinations Officer.
5. The Examinations Officer, on receipt of the above documents, shall communicate in writing to the candidate(s) concerned, the offence and regulations contravened with a request that the candidate(s) submit(s) a defence (if any) in writing to the Examinations Officer.
6. The examination result of such candidate(s) shall automatically be deferred until the relevant Committees of the University dispose of the case.
7. A copy of the letter written by the Examinations Officer shall also be sent to the Head of Department (and other relevant officers of the University) with a request that the scripts and other relevant documents connected to the case be forwarded to the Examinations Officer for the benefit of the relevant Committee if such documents had not been sent with the report already to the Examinations Officer.
8. On receipt of the letter of defence from the student, the Examinations Officer shall forward the letter and all other documents on the case to the Committee. The list of all documents forwarded shall be itemized in a covering memorandum to the Secretary, Faculty Student Disciplinary Committee of the Faculty where the reported examination misconduct took place.
9. Where there is need to call for further documents or statement from the student e.g., lecture notes for comparison with the student's answer scripts, when the allegation is about suspected unauthorized assistance to a student by another student during the examination, further communication shall be made with the student(s) and all such documents shall be passed to the Secretary of the aforesaid Committee by the Examinations officer.
10. At the appropriate Faculty Student Disciplinary Committee meeting, the Examinations Officer (or his/her Schedule Officer) shall present the exhibits for scrutiny by members of the Committee.

11. The appropriate Faculty Student Disciplinary Committee shall recommend any Student against whom a prima facie case has not been established for acquittal/ discharge.
12. The Examinations Officer shall, after the acceptance of the recommendation to discharge the affected student for lack of prima facie evidence, communicate to the Head of Department and the Dean, the outcome of the case, with the information that the Head of Department shall be requested to mark the script(s) and process the deferred results for approval and release to the student(s).
13. Each case shall be considered on its own merit and where a prima facie case of misconduct is established, the case shall be referred to the Senate Student Disciplinary committee for further disciplinary action in accordance with the procedures laid out in the student handbook.

General Instructions

Attendance

1. Attendance of 70% minimum is mandatory
2. Attendance records will be kept and used to determine each person's qualification to sit for the final examination.
3. In case of illness or other unavoidable cause of absence, the student must communicate as soon as possible with any of the instructors, indicating the reason for the absence.

Academic Integrity

Academic integrity is the expectation that all members of the department should exhibit honesty and responsibility. The following constitute academic dishonesty.

1. Violations of academic integrity, including dishonesty in assignments, examinations, or other academic performances are prohibited.
2. You are not allowed to make copies of another person's work and submit it as your own; that is plagiarism.

All cases of academic dishonesty will be reported to the University Management for appropriate sanctions in accordance with the guidelines for handling students' misconduct as spelt out in the Students' Handbook.

Supervisors and Examiners

The job of the supervisor, coordinator or advisor is to guide and advise students during the course of his studies, while the job of the examiner is to examine the student during whatever is considered to be an exam. Examiners will assess both theory and Studio projects. Below are the categories of supervisors and examiners the students in the department are most likely to encounter.

Level Coordinator

There is a Level Coordinator for every level who is to lead and co-ordinate the academic orientation of the students at that level. The Level Coordinator will have responsibility for the following activities:

1. Meet with the students for the purpose of establishing consistency and continuity of curriculum
2. Lead year level meetings
3. Coordinate the timely completion of required year level tasks.
4. Coordinate year level specific activities.

Internal Examiner
These are examiners who are from Bingham University, and who most likely will be the course lecturers except SIWES presentations.

External Examiners
An External Examiner shall be invited for the moderation of final year projects. The role of external examiners is to assure the quality of students' learning experiences and ensure that they are assessed fairly in relation to other students on the same course and to all students across our university and nationally.

Guidelines for Preparation and Submission of Projects

In Bingham University and indeed all tertiary institutions in Nigeria and beyond, research project writing is required of all undergraduate students. As an undergraduate, you are expected to carry out a research project; the work is usually divided into five chapters excluding the preliminary pages.

Components of a Project
This section contains a summary of the different sections that usually make up a project report. It should be noted that each of these pages must be started on a new page.

Cover page
The cover page contains the title of the project, the name and matriculation number of the author. The Department, Faculty and School must be written out in full. The month and year of submission must also be indicated on the cover page.

List of Reviewers

Title	Surname	First Name	Institution	Programme
Professor	DARMA	Tijjani Hassan	Bayero University Kano	Physics
Professor	EKPUNOBI	Azubike Joshua	Nnamdi Azikiwe University Awka	Industrial Physics
Professor	TIJJANI	Auwal Musa	Abubakar Tafawa Balewa University Bauchi	Physics with Electronics

List of NUC Representatives

Title	Surname	First Name	Programme
Mr.	BAKO	Audu	Physics
Mr.	OKAFOR	Ikechukwu David	Industrial Physics
Mr.	ADELEKE	Adeyemi	Physics with Electronics

List of Reviewers of the Department

Title	Surname	First Name
Dr	OYELADE	Omolara
Asso. Prof.	ADELEYE	Michael
Mr.	EMMANUEL	Paul
Mrs.	OLUWASUSI	Taye
Mr.	EGHAGE	Stephen
Mr.	ECHIODA	Emmanuel
Mr.	DANJUMA	Theophilus

TITLE OF PROJECT

NAME OF STUDENT
MATRICULATION NUMBER OF STUDENT

DEPARTMENT OF PHYSICS
FACULTY OF SCIENCES
BINGHAM UNIVERSITY, KARU

MONTH, YEAR

TITLE OF PROJECT

NAME OF STUDENT
MATRICULATION NUMBER OF STUDENT

A project reported in the Department of Physics Faculty of Sciences, Bingham University, Karu
Submitted for the partial fulfilment of the requirements
for the award of the degree of
Bachelor of Science in the Department of Physics

MONTH, YEAR

DECLARATION

I hereby declare that this project entitled “name of project” submitted in the Department of Physics, Bingham University, Karu is an original work done by me (name of student) and has not in any way been duplicated or submitted to any university for the award of any degree. All sources have been duly and properly acknowledged.

Signature and Date
Name of Student
Matriculation Number

CERTIFICATION

This to certify that the project titled "title of project" is the original work of "Name of student with matriculation number BHU/_/_/_/_____" submitted in partial fulfilment of the requirements for the award of the Degree of Bachelor of Science in the Department of Physics. We also certify that he/she has complied with the guidelines for the preparation and submission of project reports of the University.

___________________ ___________________

Name of Supervisor Date

Supervisor

___________________ ___________________

Name of Head of Department Date

Head of Department

___________________ ____________________

Name of Dean Date

Dedication page

This is where you dedicate your work to anyone you like, it could be dedicated to God, your parents, your brother or sister, it could also be to your friends, dead or alive. Please note that this is different from the acknowledgement page.

Acknowledgement page

The student here writes to appreciate all that contributed, (technical, financial, moral and otherwise) to the success of the research.

Abstract

This is the synopsis of the project report. It is often written last with the tense in past. Usually less than 250 words summarizing the problem statement, the methodology employed, the findings, conclusion and recommendations. This should be in a single paragraph and the word limit not exceeded. It has no paragraphing or indentation and the paragraph must be justified.

TABLE OF CONTENTS

A summary of what is expected in the body of the project work is seen below.

Chapter 1
This is usually the introduction. It describes the background, scope and purpose of the research. The rest of the report should be tied to the information supplied. The researcher should strive to present sufficient details regarding why the study was carried out.

Chapter 2
This is usually the literature review. This presents basically, the work done by others. It is on the ground work done by others that the current research is to be based, hence the review.

Chapter 3
This is usually the research methodology. Here the language used should be in past tense. It is a sum-up of the research design, procedures, the area and population of study. The data sampling and data sources are detailed as well.

Chapter 4
This is usually for data presentation and analysis (results and discussion). The results obtained in the research are presented here, usually, tables are used or any other visual aid like graph or charts.

Chapter 5
This is the conclusions and recommendations. From the results of the research, conclusions are made, then suggestions for improvement for other researchers with similar interest. Based on the whole happenings, recommendations are proffered.

References
This is a list of all the relevant journals, books and all sources of information consulted in the research work, either online or print. You are to use American Psychological Association (APA) style of referencing. The Level coordinator for that year will inform the students which edition they are required to use.

Appendix
This is for all extra materials that were not added to the body of the work.

Formatting Requirements

Paper quality and size

Use paper of good quality A4 sized paper. Every page must have the same margins: 25 mm all around, preferably a larger margin 38 mm on the left. If sufficient margins are not observed text or diagrams extending into the margins could be destroyed in the binding process.

Typing Format
The pages must bear print on only one side of the sheet. The spacing of the typed lines should be consistent throughout the document. Double line spacing is recommended, with the exception of

notes, long quotations, figure and table captions, appendices, and references. All work must be justified. The font type to be used is Times New Roman and the font size should be 12 points or larger; a smaller font size may be used for graphs, formulas, figure and table captions, and appendices.

Pagination

All preliminary pages (those preceding the body/main text of the project) are assigned Roman numerals (i, ii, iii, iv, etc.), however, the number does not appear on the cover page.

The pages within the body of the thesis are assigned Arabic numerals, beginning with one ("1") at the beginning of chapter 1-introduction, consecutively to the end of the thesis.

Do not begin new pagination sequences at the beginning of appendices. If appendices include material taken from other sources on which page numbers already appear (permission to reproduce this material having been received, if necessary), they must also carry numbers conforming to the pagination of the thesis or dissertation.

Requirements for Submission

Binding

You must make sure that your project meets the university's formatting and binding requirements. Your project must be written in English. The approved project report must be hard bound in black. The writing should be in gold.

On the spine, the author's initials, surname, title of degree, and year of award shall be written in that order all in capital letters starting from the lower end of the project report (with the project report held vertically).

DEGREE	**YEAR**	**SURNAME, INITIALS**

Submission

After the approval of your project report, you are required to submit signed and stamped copies of the project report. You are required to submit 5 copies. 1 copy to the school library, 1 to the faculty library, 1 to the departmental data room, a copy to your supervisor, a soft bound copy to your supervisor and a personal copy.