

**GODFREY OKOYE UNIVERSITY
ENUGU, ENUGU STATE, NIGERIA**

www.gouni.edu.ng



B.SC. PHYSICS WITH ELECTRONICS

Student Handbook

2023 - 2028

Overview

The programme is intended to equip the students with broad knowledge of Physics and electronics to address the challenges of the 21st century. The classroom instruction includes lectures and laboratory research. Students industrial work experience scheme (SIWES) is included in the syllabus to provide students with necessary skills for employment and entrepreneurship. The first and second year comprise of introductory courses in physics, mathematics, computer science and general studies. Foundation courses in physics that underpin an understanding of electronics and basic electronics courses are provided at the third and fourth year with entrepreneurship courses that will equip the graduates of the programme with relevant skills for job creation and innovations in the areas of applied physics and electronics

Philosophy

The curriculum of physics with electronics is meant to broaden the electronics engineering base of students who may wish to study pure electronics with physics without the Electrical Engineering aspects and also prepares them for higher degrees in Physics and Electronics Engineering. The programme is designed to give the students theoretical and practical skills in the areas of applied physics and electronics such as medical radiology, magnetic resonance imaging, analogue electronics systems, digital electronics systems, etc.

Objectives

The objectives of the programme are to:

1. involve the students in intellectually stimulating and satisfying experience of learning and studying;
2. prepare the students for advanced Physics and professional fields of Electronics Engineering;
3. prepare students with skills for self-reliance and entrepreneurship;
4. prepare the students for postgraduate studies in either Physics or Electronics Engineering; and
5. prepare the students for research and innovation advancement in Physics and Electronics Engineering.

Unique Features

1. The programme is unique in the way in which it is designed to provide the students with broader knowledge of physics and electronics so that they can utilize modern discoveries in physics for innovations in electronics.
2. The programme is also unique in the way in which applied physics and digital electronics system courses are included in the curriculum to prepare the students for global challenges.

Employability Skills

The programme is designed to provide the students with employability skills in the following areas:

1. IT Skills
2. Time management
3. Creativity
4. Resourcefulness
5. Communication
6. Organization

21st Century Skills

The 21st century skills of the programme are

1. Communication
2. Creativity
3. Collaboration
4. Critical Thinking
5. Innovation
6. Technology literacy
7. Flexibility

Admission and Graduation Requirements

Admission Requirements

The entry requirements shall be at least passes at credit level at Senior Secondary Certificate (SSC) in five subjects at not more than two sittings. Such subjects include English Language, Mathematics, Physics and Chemistry. In addition, an acceptable pass in the Unified Tertiary Matriculation Examination (UTME) is required for admission into 100 Level.

Candidates with at least two A level passes in Physics and Mathematics at the Advanced Level may be considered for admission into 200 Level.

Graduation Requirements

Expected duration for UTME candidates shall be 4 years and students are required to pass a minimum of 120 units, while for direct entry students, expected duration for graduation shall be 3 years and would be expected to pass a minimum of 90 units which must include all compulsory courses.

Course Structure

100 Level

Course Code	Course Title	Unit(s)	Status	LH	PH
GST111	Communication in English	2	C	15	45
GST 112	Nigerian Peoples and Culture	2	C	30	-
MTH 101	Elementary Mathematics I	2	C	30	-
MTH 102	Elementary Mathematics II	2	C	30	-

COS 101	Introduction to Computing Sciences	3	C	30	45
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
GOU-PHY 111	General Chemistry for Physics I	2	C	30	0
GOU-PHY 112	General Chemistry for Physics II	2	C	30	0
GOU-PHY 131	General Chemistry Practical for Physics I	1	C	0	30
	TOTAL	26			

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 205	Thermal Physics	3	C	45	-
PHY 206	General Physics VII (Energy & Environment)	2	C	30	-
PHY 211	Workshop Practice	2	C	15	45
PHY 213	Classical Physics I	2	C	30	
GOU-PHY 204	Introduction to Web Technologies	2	C	15	45
GOU-PHY 212	Workshop Practice II (Electronics)	1	C	0	45
GOU-PHY 223	Computer Programming for Physics I	3	C	30	45
GOU-PHY 235	Introduction to Space Science	2	E	15	45
GOU-PHY 241	Electrical and Electronic circuit design	2	E	15	45
GOU-PHY 261	MATLAB for Physics	2	C	15	45
	TOTAL	25			

300 Level

Course Code	Course Title	Unit(s)	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 305	Quantum Physics	3	C	45	-
PHY 306	Statistical and Thermal Physics	2	C	30	-
PHY 312	Analogue Electronics	2	C	30	-
PHY 315	Electronics	2	C	30	-
PHY 316	Circuit Theory	2	C	30	-
PHY 317	Experimental physics V	1	C	-	45
PHY 325	Measurement and Instrumentation	2	C	30	-
PHY 399	Industrial Attachment	3	C		
GOU- PHY 309	Artificial Intelligence	2	C	15	45
GOU- PHY 324	Computer Programming for Physics II	3	C	30	45
GOU- PHY 331	Renewable energy I	2	C	30	0
GOU- PHY 371	Robotic Systems	3	C	30	45
	TOTAL	36			

400 Level

Course Code	Course Title	Unit(s)	Status	LH	PH
PHY 401	Quantum Mechanics I	3	C	45	-
PHY 403	Mathematical Methods in Physics I	3	C	45	-
PHY 404	Mathematical Methods in Physics II	3	C	45	-
PHY 413	Digital Systems	2	C	30	-
PHY415	Digital Communication Systems	2	C	30	
PHY417	Advanced Electronics Lab	1	C	-	45
PHY422	Digital Electronics	2	C	30	-

PHY423	Entrepreneurship in Physics Electronics	2	C	30	
PHY499	Project	6	C	-	270
GOU-PHY 418	Design and Installation of Electrical & ICT Equipment	2	E	15	45
GOU-PHY423	Nuclear Physics	3	C	45	0
GOU-PHY 452	Remote Sensing	2	E	30	0
GOU-PHY 488	Renewable energy II	2	C	15	45
	TOTAL	33			

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 movements 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 justice and national development (law definition and classification. Judiciary and fundamental 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; 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.

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.

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 basic definition of set, subset, union, intersection, complements and use of Venn diagrams;
2. solve quadratic equations;
3. solve trigonometric functions;
4. identify 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 in differentiation and Integration;
2. describe the meaning of Function of a real variable, graphs, limits and continuity; 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, volumes.

PHY 101: General Physics I (Mechanics)

(2 Units C: LH 30)

Learning Outcomes

Upon the completion of course, the student 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, 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

On completion, the 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

On completion, the 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, Q values and power response curves, Forced SHM, resonance and transients, Coupled SHM. 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 1-D wave equation, 2-D and 3-D wave equations, wave energy and power, phase and group velocities, echo, beats, the Doppler effect, Propagation of sound in gases, solids and liquids and their properties.

Optics: nature and propagation of light; reflection, refraction, and internal reflection, dispersion, scattering of light, reflection and refraction at plane and spherical surfaces, thin lenses and optical instruments; wave nature of light; Huygens's principle, interference and diffraction.

PHY 107: General Practical Physics I

(1Unit C: PH 45)

Learning Outcomes

On completion, the 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, the treatment of measurement errors, and graphical analysis. A variety of experimental techniques should be employed. 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

On completion, the 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

GOU-PHY 111: General Chemistry for Physics (2 Units; Compulsory; LH = 30; PH= 0)

Senate-Approved Relevance

Knowledge of physical chemistry is very vital for Physics with Electronics students to hone their skill sets on chemical reactions involved in fabrication of electronic devices in micro- and nano-scales respectively. Chemistry is the fundamental knowledge of atoms, elements, compounds, and their interaction in an environment. Physics, Electronics, Micro-electronics, Nanoscience & Technology are the brain behind the disruptive technologies in the present state-of-art-facilities deployed in achieving high-level imaging in hospital, industries, space, and oil and gas sectors as well as other life science sectors. Therefore, fabrication/manufacturing of electronics devices/chips in micro- and nano-scales **and** gradually shifting to pico-scale are the new paradigm in the disruptive technologies deployed for diverse applications/usage. This aligns with Godfrey Okoye University's mission to empower their graduates with skills for the labour market.

Overview

GOU-PHY 111 intend to acquaint the Physics with Electronics students with basic knowledge of atom, element and compounds and their interactions via electrovalent, covalent, and other chemical bonding. GOU-PHY 111 utilize the Periodic Table to teach the students the arrangement of atoms and their valency electrons. Electronic configuration of elements in Periodic Table, and identification of characteristics of acids, bases, and salts and knowledge of chemicals reactions between these substances are prerequisites for Thin Film technology in micro-and nano-scales.

Chemistry is highly relevant in the study of physics because it provides a fundamental understanding of the behavior of matter and its interactions. Physicists use the knowledge of chemistry to explain the behavior of atoms and molecules, and to understand the chemical reactions that occur between them. Some specific areas where chemistry is relevant to physicists includes Atomic and molecular physics, Materials science, nuclear physics, etc. Overall, chemistry provides a crucial foundation for many areas of physics, and the two fields are closely intertwined. Many of the most important scientific discoveries in history have been the result of collaborations between physicists and chemists.

Objectives

The objectives of this course are to:

1. Explain chemical bonding between an atom/elements.
2. Discuss modern electronic theory of atoms.
3. Write electronic configurations of elements in the Periodic Table.
4. Identify and balance oxidation – reduction reactions.
5. State LeChatelier's principle and apply it to solving problems.
6. Analyze and perform calculations on the thermodynamic variables.

Learning Outcomes

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

1. Define atom, molecules and explain chemical bonding between atoms/elements.
2. Discuss the Modern electronic theory of atoms.
3. Write electronic configurations of elements in the periodic table.
4. Justify the trends of atomic radii, ionization energies, electronegativity of the elements based on their position in the periodic table.
5. Identify and balance oxidation – reduction equation and solve redox titration problems.

6. Illustrate shapes of simple molecules and hybridized orbitals.
7. Identify at least four characteristics of acids, bases and salts, and solve problems based on their quantitative relationship.
8. Apply the principle of equilibrium to aqueous systems using LeChatelier's principle.

Course Content

Atoms, molecules, elements and compounds and chemical reactions. Modern electronic theory of atoms. Electronic configuration. Periodicity and building up of the periodic table. Hybridization. Shapes of simple molecules. Valence Forces and 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. Electrochemistry. Radioactivity.

Minimum Academic Standards

Chemistry laboratory with NUC-MAS requirements and facilities.

GOU-PHY 112: General Chemistry for Physics II (2 Units; Compulsory; LH = 30; PH = 0)

Senate-Approved Relevance

A course on General Chemistry for Physics students intends to train the students on the qualitative and quantitative structure and analysis and identification of organic compounds. The chemistry of alkanes, alkenes, alkynes, alcohols, ethers, amines, alkyl halides, nitriles, aldehydes, ketones, carboxylic acids and their derivatives will be extensively discussed. Given this, Physics with Electronics students will leverage on this basic knowledge, while advancing their potentials, knowledge, and skillsets in Thin film technologies. This is in unison with the Mission, Vision and philosophy of Godfrey Okoye University to empower their students with

strong knowledge and skillsets and produce graduates that will be outstandingly excellent in their careers.

Overview

Knowledge of organic chemistry complement that of the physical chemistry. Knowledge of GOU-PHY 112 alongside GOU-PHY 111 exposes Physics with Electronics students to the structure of chemical compounds, and acquaint them with the knowledge and skillsets needed to balance chemical equations of salts/substances used in Thin film technology. Advancing in Micro-electronics and Nanoscience and Technology, medical physics, etc after graduation without the prerequisite knowledge of chemistry will have deficiency and knowledge gap on nano-research, fabrication of electronic and biomedical chips.

Given the above, Physics with Electronics students can identify the chemical structure of alkanes, alkenes, alkynes, alcohols, ethers, amines, alkyl halides, nitriles, aldehydes, ketones, and their derivatives, and employ their knowledge and skillsets in Micro-electronics and Nanoscience and Technology study and advancement.

Objectives

The objectives of the course are to;

1. Discuss the importance of organic chemistry.
2. Discuss the qualitative and quantitative structure and analysis in organic chemistry.
3. Discuss the rules guiding the nomenclature and functional group of organic chemistry.
4. Predict mechanisms and determine the rate of chemical reactions.
5. Discuss comparative chemistry of group 1A, IIA and IVA elements.
6. Discuss basic properties of Transition metals.

Learning Outcomes

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

1. State the importance and development of organic chemistry.
2. Define fullerenes and state its applications.
3. Determine the qualitative and quantitative of structures in organic chemistry.
- 4 Describe rules guiding nomenclature and functional group classes of organic chemistry.
5. Determine rate of reaction to predict mechanisms of reaction.
6. Identify classes of organic functional group with brief description of their chemistry.
7. Discuss comparative chemistry of group 1A, IIA and IVA elements.

8. Describe basic properties of Transition metals.

Course Content

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

Minimum Academic Standards

Atomic model structure, Acids, Base, Salt, chemical compounds, chemistry text book, Periodic table chart, and other instructional materials class room, overhead projector, laptop. Atomic model structure, Acids, Base, Salt, chemical compounds, chemistry text book, Periodic table chart, and other instructional materials, overhead projector, laptop, Fume Chamber, Laboratory Fume Hood, Laboratory pH Meter -2, Distillation Unit Apparatus Model, Electronic Balance, Mass spectrometer, Flame photometer, Overhead tanks, glassware. UV Spectrophotometer and infra-red spectrometer.

GOU-PHY 131: General Chemistry Practical for Physics I (1 Unit; Compulsory; LH = 0; PH = 30)

Senate-Approved Relevance

This course acquaints the Physics with Electronics students with the general laboratory rules and safety measures, identification of glassware and other chemistry wares, instruments and equipment. The course aims to inculcate in Physics with Electronics students the rudiments of scientific data collection, analysis and interpretation in chemistry. This agrees with Godfrey Okoye University's philosophy, mission and vision to produce graduates who will be outstanding in learning, character and epistemic knowledge in all its ramifications.

Overview

GOU-PHY 131 introduces students to general rules, safety procedures and techniques in chemical laboratories, and trains them on the step-by-step approaches in identification of chemical wares and instruments as well as carrying out quantitative and qualitative experiments to collect, analyze and interpret data.

The students will acquire the in-depth knowledge of laboratory techniques, be able to handle glassware, and carry out qualitative and quantitative analysis. Moreover, Physics with Electronics students shall employ the acquired knowledge and skillsets in advancing their study.

Objectives

The objectives of the course are to;

1. Discuss the general chemical laboratory rules and safety measures.
2. Identify the chemical wares and instruments.
3. Care and maintain chemical wares and instruments.
4. Discuss rudiments of scientific data collection.
5. Carry out quantitative and qualitative experiment.
5. Analyze data, interpret the results and draw conclusions.

Learning Outcomes

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

1. Describe the general laboratory rules and safety procedures.
2. Collect scientific data and carry out qualitative and quantitative analysis.
3. Identify the basic glassware and equipment in the laboratory.
4. Perform redox titration.
5. Record observations and measurements in the laboratory notebooks.
6. Analyze the data to arrive at scientific conclusions.

Course Content

Laboratory experiments designed to reflect topics presented in courses GOU-PHY 111 and GOU-PHY 112.

These include acid-base titrations, qualitative analysis, redox reactions, gravimetric analysis, data analysis and presentation.

Minimum Academic Standards/Requirements

Atomic model structure, Acids, Base, Salt, chemical compounds, chemistry text book, Periodic table chart, and other instructional materials, Laboratory, glassware; beaker, pipette, burette, conical flask. Fume Chamber, Laboratory Fume Hood, Laboratory pH Meter -2, Distillation Unit Apparatus Model, Electronic Balance, Mass spectrometer, Flame photometer, Overhead tanks, glassware. UV Spectrophotometer, etc.

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 assess 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 molding, 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
2. seeking, new value creation, and risk taking;
3. state the characteristics of an entrepreneur;
4. analyse the importance of micro and small businesses in wealth creation, employment,
5. and financial independence;
6. engage in entrepreneurial thinking;

7. identify key elements in innovation;
8. describe stages in enterprise formation, partnership and networking including business planning;
9. describe contemporary entrepreneurial issues in Nigeria, Africa and the rest of the world; and
10. state the basic principles of e-commerce.

Course Contents

Concept of entrepreneurship (entrepreneurship, intrapreneurship/corporate entrepreneurship,). Theories, rationale and relevance of entrepreneurship (Schumpeterian and other perspectives, risk-taking, necessity and opportunity-based entrepreneurship and creative destruction). 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 joint 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 205: Thermal Physics

(3 Units C: LH 45)

Learning Outcomes

On completion, the 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. Van der Waals gas. Kinetic theory. Mean free path. Equipartition of energy. Heat transfer. Diffusion rate.

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

On completion, the 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 211: Workshop Practice**(2 Units C: LH 15; PH 45)****Learning Outcomes**

On completion, the 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; and
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.

PHY 213: Classical Physics I

(2 Units C: LH 30)

Learning Outcomes

On Completion, the students should be able 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.

Course Contents

Introduction to classical mechanics. Space and time. Linear kinematics. Linear and angular momentum. Force and torque. Motion in a plane. Newtonian gravity. The two-body systems. Forces and equilibrium. Particle dynamics. Force fields and potentials. Collisions. Conservative forces. Inertial frames and non-inertial frames. Motion in rotating frames. Centrifugal force. Central force motions. Kepler's motion in a central force field. Particle orbits as conic sections. Kepler's laws. Rigid body motion and rotational dynamics. Moment of inertia. Free rotation and stability. Gyroscopes.

GOU-PHY 204: Introduction to Web Technologies (2 Units; Compulsory; LH = 15; PH = 45)

Senate-Approved Relevance

Web site design is a lucrative business. This course is developed to impart positive solid educational experiences on Graphic design, Website design/development, and Hosting. Given this, Physics with Electronics graduates who will be outstandingly excellent in learning, and in character which is in agreement with GOU's mission and vision to empower their graduates with knowledge and skillsets to be competitive in the labour market. Moreover, this course is fashioned in line with the philosophy of GOU towards producing Physics with Electronics graduate who will be competent in interactive graphics and multimedia content creation, and as well as become entrepreneur.

Overview

Designing website for intending clients is a lucrative business in Nigeria today. We are in a digital era and for any business to excel, owning a website is the criterion for accessing business grant from private and Government as well as business collaborations. Web Technology will acquaint Physics with Electronics undergraduate students with prerequisite skillsets in website design and development.

The students will be able to design website for clients. This would make them an outstanding entrepreneur and consultants to prospective clients. Also, the acquired skillsets from Web technologies would make the students competitive in labour market to provide wanting website's services to their employer and general public at large.

Objectives

The objectives of the course are to;

1. Discuss the origin of internet and World Wide Web.
2. Discuss different programming languages.
3. Discuss website creation using different programming languages.
4. Discuss graphic designs.
5. Discuss multi-media content creations.
6. Discuss impact of the World Wide Web on people's lives over time.
7. Design Website and host it.
8. Discuss website management.

Learning Outcomes

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

1. State the origin of the internet and the World Wide Web.
2. Create simple web content using HTML, CSS, and JavaScript.
3. Use simple application frameworks to develop web content.
4. Explain the impact of the World Wide Web on people's lives over time.
5. Host Website for clients.
6. Manage Websites for clients.
7. Upgrade website from time-to-time for clients when the need arise.

Course Content

Introduction to the internet. World Wide Web (WWW), and web development. WWW as a platform for interactive applications. Content creation, publishing, and social services. The role of HTTP and HTTPS in the context of web applications. Roles and operations of web browsers and the web-server. Interacting with web applications (through forms, and using style sheets to separate document structure and document formatting). Web development tools and frameworks. Building a simple website that: organises information effectively, uses valid HTML and CSS, and applies appropriate web standards (from standards bodies such as W3C). HTTP communication protocol. The mark-up languages HTML, XHTML, and XML, the CSS and XSLT standards for formatting and transforming web content. Interactive graphics on the web. Multimedia content on the web. Client-side programming using JavaScript. Impact of the World Wide Web on people's lives over time. **Lab Work:** Simple form-based web applications. Developing simple websites using web development tools and frameworks; using the mark-up languages HTML, XHTML and XML; using JavaScript.

Minimum Academic Standards/Requirements

Overhead projector, smart board, text books on website design and development, different website design software packages, internet access, Computer systems with capacity to run software systems, Programming environment and tools (e.g., Compilers/interpreters, debuggers, etc. for Java, Python, compiler compilers, e.g., flex, yacc, SableCC, etc.), Operating systems environments and tools (e.g., Windows, LINUX, TempOS, Nachos, Xinu or MiniOS), Tools for systems analysis and design (e.g., Unified Modelling Language (UML)).

GOU-PHY 212: Workshop Practice - Electronics (1 Unit; Compulsory; LH = 0; PH = 45)

Senate-Approved Relevance

GOU-PHY 212 is a skill acquisition course fashioned to empower the Physics with Electronics students with the technical know-how and rudiments in electronics laboratories and industries. The students will be acquainted with knowledge and skillsets in circuit simulation, implementation, constructions as well as soldering techniques, and use of electronics test instruments in the laboratories and industries. This is in agreement with Godfrey Okoye University's mission and vision to empower their graduates with knowledge and skillsets in order to be competitive and outstandingly excellent in the labour market.

Overview

Physics is an indispensable tool for National development and technical know-how is fundamental for technological start-up. This course content is technically based, and it intend to acquaint the students with the technical skillsets that will make them outstanding and competitive in the industries, companies, and other sectors of the labour market.

This course train the students on electronics component identification, circuit drawing and simulations and construction. The students will be able to simulate and construct circuits as well as maintenance and repairing of some electronic instrument. Also, the students can be an entrepreneur; designing and construction of customized circuits and electronic gadgets for clients at the end of this course

Objectives

The objectives of the course are to:

1. Discuss the safety rules and precautions in electronic workshops/industries.
2. Identify electronic components, instrument and equipment.
3. Design and simulate three circuit diagrams using Proteus version 8.0.
4. Implement and construct electrical/electronic circuits.

5. Use test instruments and make measurements.
6. Maintain, troubleshoot, and repair minor faults in electronic equipment.

Learning Outcome

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

1. State the safety rules and precautions in electronic workshops/industries.
2. Identify electronic components, instruments/equipment.
3. Design and simulate circuit diagrams using Proteus version 8.0.
4. Implement and construct electrical and electronic circuits.
5. Use test instruments and make measurements.
6. Maintain, troubleshoot, and repair minor faults in electronic equipment.

Course Content

Safety rules and precautions in electronic workshop and industries. Identification of electronic tools, circuit symbols of electronic components/instrument/equipment. Color codes in resistors and capacitors. Electronic sensors and uses/applications. Circuit Amplification using BJT and MOSFET. Positive and negative feedback circuits. Integrated circuits and identification. Soldering techniques and safety precautions. Use of test instrument/equipment (like multi-meter, Oscilloscope, Signal generator, and signal analyzer). Circuit design/modification and simulation using Proteus version 8.0. Simulations of different circuits (e.g. power supply, BJT amplification, MOSFET amplification, OP amp, Monostable and multistable vibrators, and selected practical circuits). Circuit implementation and construction and testing. Transformer, wire gauge, and design and construction of transformers. Construction of practical circuits. Electronic maintenance, troubleshooting, and repairing techniques. Electronic control of industrial processes.

Mini project: circuit simulation, implementation and construction as assigned by the Lecturer/Technologist.

Minimum Academic Standards

Classroom, White board and marker, overhead projector, Vero board, Bread boards, electronic components(capacitors, resistors, etc), soldering iron and lead, sucker, electronics kit/tools, pliers, wire cutter, handheld lens, jumper wire, Laptops, Proteus software, internet access,

programmable circuits/ICs and kits and accessories, IC tester, Functional fire extinguisher, Well-equipped first aid box, Analog ICs, Logic gates, Signal analyzer, Microprocessors, Connection wires, Multi-meter, Oscilloscopes (Analog and Digital), Function/signal generator, air blower, transparent eyeglasses.

GOU-PHY 223: Computer programming for Physics I (3 Units; Compulsory; LH = 30; PH = 45)

Senate -Approved Relevance

This course is developed to equip the students of Physics with the prerequisite knowledge and skillsets in computer coding and writing programs. This course acquaints Physics students with the basic and intermediate knowledge and skillsets in computer coding and programming. It is fashioned in line with the Godfrey Okoye University's Philosophy, Mission, and Vision to empower their graduates with skillsets and to producing Physics graduate concepts complementary with applications that will advance their knowledge in coding and use of programming languages for advanced computation and programming in Physics and applications.

Overview

Digitization has broadened our concept and utilization of most electronic devices/gadgets. Developing of Apps, Games, and softwares requires in-depth knowledge and skillsets in coding and programming. Therefore, GOU-PHY 223 will impart positively on the students the coding and programming skillsets. These skillsets when acquired will nurture and prepare the students to be competitive in the labor market to be outstanding in their discharge of duty.

Besides the ability to be a consultant to many young students that want to path their career in the same profession as well as provide services to clients, companies, a good programmer can construct digital circuit which requires programmable IC's. Basic, intermediate, and advanced programming skillsets is paramount in building Hi-tech circuit deployed in drones and other electronic devices used in tackling security, and monitoring and imaging.

Objectives

The objectives of this course are to:

1. Identify different programming paradigms.
2. Discuss how to write programmes.

3. Design and implement programming problems.
4. Classify data abstractions.
5. Develop programmes.
6. Design and implement programming problems involving arrays.

Learning Outcomes

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

1. Identify at least three programming paradigms and their approaches to programming.
2. Write two programmes using basic data types and strings.
3. Design and implement two programming problems using selection and loops.
4. Use and implement classes as data abstractions in an object-oriented approach.
5. Implement simple exception handling in programmes.
6. Develop at least three programmes with input/output from text files.
7. Design and implement two programming problems involving arrays.

Course Content

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, such as Java. Basic data types. Variables. Expressions. Assignment statements and operators. Basic object-oriented concepts: abstraction, objects, classes, methods, parameter passing, encapsulation. Introduction to Strings and string processing; Simple I/O; control structures; Arrays; Simple recursive algorithms; inheritance; polymorphism. **Labwork:** Programming assignments involving hands-on practice in the design and implementation of simple algorithms such as finding the average, standard deviation, searching and sorting. Practice in developing and tracing simple recursive algorithms. Developing programmes involving inheritance and polymorphism.

Minimum Academic Standards/Requirements

Computer systems with capacity to run software systems, Programming environment and tools (e.g., Compilers/interpreters, debuggers, etc. for Java, Python, C+, C++, compiler compilers, e.g., flex, yacc, SableCC, etc.), Operating systems environments and tools (e.g., Windows, LINUX, TempOS, Nachos, Xinu or MiniOS), Tools for systems analysis and design (e.g., Unified Modelling Language (UML)).

GOU-PHY 235: Introduction to Space Science (2 Units; Elective; LH =30; PH = 0)

Senate-Approved Relevance

This course intends to acquaint students of Physics with Electronics with the basic knowledge and skillsets in Space Science, Astronomy/Astrophysics and Cosmology. The course exposes the students to planetary system, night-sky observation, Optical telescope techniques, observatories, Galaxies, Constellation, Big Bang theory, Universe and space business enterprise. The course is proposed as a requirement of Godfrey Okoye University's mission to produce graduates who will be outstandingly excellent in learning, balanced in character and personality and ready to pursue epistemic unity. Graduates of this course can advance their career in Space Physics and Technology, as well as space entrepreneurship.

Overview

This is a foundation course for Astronomy and Astrophysics. This course acquaints the students with knowledge and skillsets optical telescopes, observatories, observation techniques, solar system and three body motion system, characteristics of major planets and dwarf planets, stellar evolution and identification of some planets and other celestial objects in the night-sky using naked eye, planetarium, and other astroApps, galaxy formation and morphology, Big Bang phenomenon and origin of the universe, cosmology, extraterrestrial life and civilizations.

Students who offer this course can advance their career in Space Science/Astrophysics, Cosmology, Atmospheric science, Climatology, and Space Physics. Moreover, the students can look up to the sky and identify some stars and planet.

Objectives

The objectives of the course are to:

1. Discuss the operational mechanisms of Optical telescopes.
2. Discuss Solar system, and explain the characteristics of major and dwarf planets.
3. Classify stellar objects.
4. Discuss the life cycle of star.
5. Discuss how to identify stellar objects on the night sky using naked eye, skyApps and software.
6. Discuss Galaxies and their morphology.
7. Explain Big Bang and origin of life in the universe.

8. Discuss space business enterprise.

Learning outcomes

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

1. Explain the principle of Optical telescope.
2. Mention the major planets that make up the Solar system.
3. State the characteristics of the major planets in the Solar system.
4. Explain and classify stellar objects.
5. Explain the stages of life cycle of a star.
6. Identify some stellar object in the night sky using naked eye.
7. Explain different types of galaxies and their morphology.
8. Explain Big Bang and understand the origin of the universe.

Course content

Introduction. Electromagnetic wavebands. Telescopes and observatories. Solar system. Constellation. Stellar objects and classification. Stellar evolution. Hertzsprung-Russel diagram. Galaxies. Hubble's law. Cosmology. Big Bang and Origin of the Universe and life. Satellite Communication. Introduction to Atmospheric Science. Space Environment. Basic principle and dynamics of spacecraft systems. Aero/Astro dynamics and Rocket Engineering. Space law.

Minimum Academic Standards/Requirements

Classroom, White board and marker, overhead projector, Laptop, textbooks on Astronomy, Astrophysics space science and cosmology, Planetarium stellerium software, Astrosky night software, Telescope model terrestrial, Astronomical telescope, instructional materials. Internet access.

GOU-PHY 241: Electrical and Electronic circuit design (2 Units; Elective; LH = 15; PH = 45)

Senate-Approved Relevance

This course is developed to impart solid and positive educational experience on Physics with Electronics students. This course acquaint the Physics with Electronics students the theoretical and practical fundamental knowledge of circuit diagram, circuit design, analysis and problem-solving. GOU-PHY 241 inculcate in Physics with Electronics students the prerequisite knowledge and skillsets on circuit design, drawing and simulation. Given this, Physics with Electronics students will be outstandingly excellent in learning, balanced in character and personality and ready to pursue epistemic unity in agreement with Godfrey Okoye University's mission and vision to empower their graduates with knowledge and skillsets to fit into the labour market. Furthermore, graduates of this course can become entrepreneurs.

Overview

This course exposes the students to the principle and applications of electrical and electronic circuits. The student will be acquainted with the theoretical and practical knowledge and technical skillsets in electrical and electronic circuits. The circuit laws and circuit network analysis would be extensively discussed and these will broaden the students' horizon on the concept and techniques involved in circuit design, simulation, implementation, and construction.

Given the above, the students will be able to explain fundamental circuit laws and employ their knowledge in circuit design and simulation in order to modify, customize and construct robust electronic devices for individual and industrial purposes, thereby becoming entrepreneurs and also be able to compete in the labour market and advanced studies.

Objectives

The objectives of the course are to:

1. Explain the sources of voltage (e.m.f) and current.
2. Discuss basic circuit laws.
3. Explain circuit theorem and network analysis.

4. Analyze circuit, and solve problems.
5. Explain RLC circuit networks.
6. Explain resonance in series and parallel RLC circuit.
7. Circuit diagrams, drawing and simulations.

Learning outcomes

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

1. Differentiate between D.C and A.C voltage and current sources.
2. State circuit theorem, analyze circuit and solve-problems.
3. Calculate current, voltage, energy and power in any circuit.
4. Explain RLC circuit networks, and conditions for resonance to occur.
5. Determine the impedance and resonant frequency of RLC circuits.
6. Draw and simulate circuit diagrams using Proteus 8.0 V.

Course Content

Sources of e.m.f and current. Basic circuit laws (Ohm's law, Kirchhoff's voltage and current laws; Nodes, Branches and loops). Series elements and voltage division. Parallel elements and current division. Star-Delta transformation. A.C. Fundamentals: Review of Complex Algebra. Sinusoids, Phasors, Impedance and Admittance. Mesh and Nodal analysis. RMS and Average values. Steady-state analysis of series and parallel combination of RLC with sinusoidal excitation. Resonance: Resonance in Electrical circuits, Analysis of series and parallel Resonance. Impedance and resonance frequency. Instantaneous power. Real, Reactive and Apparent power. Concept of Power factor, Electrical energy and Power. Frequency. Circuit theorems and network analysis (superposition theorem. Thevinin's theorem. Norton's theorem. Maximum power transfer theorem. Reciprocity theorem). Circuit drawing and simulation using Proteus Version 8.

Minimum Academic Standards/Requirements

Classroom, White board and marker, overhead projector, electronic components, Laptops, Proteus software, internet access, handheld lens, Functional fire extinguisher, Well-equipped first aid box, Multi-meters, Electronics kit, Programmable logic gates, Microprocessors.

GOU-PHY 261: MATLAB for Physics (2 Units; Compulsory; LH = 15; PH = 45)

Senate-Approved Relevance

MATLAB is robust software for computation, data analysis, coding and programming. GOU-PHY 261 shall acquaint Physics with Electronics students with basic and intermediate knowledge in computation, data handling, data analysis, 2-D and 3-D graph plotting and interpretation of results as well as coding techniques. Given this, the students can process big data, analyze them and interpret the results. With a physical equations and data available, students can write MATLAB codes for computations and 2-D and 3-D graph plotting and visualization. This aligns with Godfrey Okoye University's mission to inculcate in students a strong personality that will promote epistemological dialogue and balanced character in learning and otherwise to pursue epistemic unity. Graduates of this course will be empowered with knowledge and skillsets to compete in the labour market, as well as become entrepreneurs.

Overview

MATLAB stands for MATrix LABoratory. It is a software package designed for handling calculations, high performance computation and visualization involved in scientific and engineering problems. You can type commands at the MATLAB prompt line and get answered immediately. With MATLAB, one can design, develop, and implement computational and graphic tools to do relatively complex problems. Students on this course will be able to modify the way they interact with MATLAB, and develop a toolbox of their own that helps them to solve problems that are of interest to them.

Students will be able to carry out data processing and analysis, 2-D and 3-D plotting and visualization and interpretation. Students can employ their knowledge and skillsets in

handling complex data in industries, organizations, private, and government sectors where robust interpretation of data is highly demanded.

Objectives

The objective of the course are to:

1. Explain MATLAB software and its uses/applications.
2. Discuss features of MATLAB environment.
3. Explain MATLAB inbuilt functions.
4. Discuss how to write MATLAB syntax/codes and scripts.
5. Discuss the techniques of file processing.
6. Discuss data analysis and visualization in 2-D and 3-D.
7. Discuss simulation techniques.

Learning outcomes

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

1. Explain all the features of MATLAB environment.
2. List eight MATLAB functions and in-built functions.
3. Use MATLAB to solve matrices and problems.
4. Write MATLAB codes.
5. Write MATLAB script using Editor.
6. Write data to files and make 2-D and 3-D plots.
7. Visualize 2-D and 3-D plots and interpret results.

Course content

Introduction. Overview of the main features of MATLAB. Variable and functions. Basic arithmetic operators. Intrinsic and in-built functions. Matrices and Arrays. Solving numerical problems. Editor and its tools. Codes and Scripting. Data processing. Writing data to file. Style markers and colour. 2D and 3D data plotting. Visualization. Graph interpretation. Imaging. Mapping.

Minimum Academic Standards/Requirements

Classroom, White board and marker, overhead projector, Laptop, textbooks on MATLAB, MATLAB software. Internet access.

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; and
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, 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-Junkun; Zango Kataf, 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. 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, IDPs. 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

On completion, the students should be able to:

1. explain 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 generalised motion;
6. explain the theory of relativity;

7. identify an appropriate set of generalised coordinates to describe a dynamical system and obtain its Lagrangian in terms of those coordinates and the associated 'velocities'; and
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

On completion, the students should be able to;

1. derive Maxwell's equation set from the empirical laws of electromagnetism;
2. identify 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; and
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's 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 305: Quantum Physics

(3 Units C: LH 45)

Learning Outcomes

On completion, the 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; and
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

On completion, the 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;
6. explain the physical origin of Bose-Einstein condensation, to characterise it quantitatively, and to explain the experiments confirming Bose-Einstein condensation.

Course Contents

Basic theory of thermodynamics. Basic of probability theory. Microstates and macrostates. 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. FermiDirac and Bose-Einstein distributions. The ideal Fermi gas. Fermi energy. Heat capacity. The ideal Bose gas. Black body radiation. Bose-Einstein condensation.

PHY312: Analogue Electronic Circuits

(2 Units C: LH 30)

Learning Outcomes

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

1. explain single stage transistor amplifiers and operational amplifier circuits;
2. analyse and design multistage amplifiers;
3. design and analyse broadband and narrow band amplifiers circuits;
4. design and analyse RC and LC crystal oscillators circuits; and
5. develop skills to build and troubleshoot analogue electronic systems.

Course Contents

Review of single stage transistor amplifiers and operational amplifier circuits. Analysis and design of multistage amplifiers. Feedback, broadband and narrow band amplifiers, power amplifiers, voltage and current stabilizing circuits. Sinusoidal RC and LC crystal oscillators, other communication circuits.

PHY315: Electronics

(2 Units C: LH 30)

Learning Outcomes

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

1. describe behaviours of semiconductors and their significance in the development of modern electronics;
2. explain the operation of semiconductor devices and their advantages over their vacuum tube counter parts; and
3. demonstrate the significance of modulation in telecommunication.

Course Contents

Thermionic emission, vacuum tubes: diodes and transistors; semiconductors; p-n junction; characteristics of p-n junction; uses of diodes; bipolar junction and unipolar transistors, transistor biasing, transistor switch. Equivalent circuits of semiconductors, diodes, transistors. Small and large signal operations. Wave from generation by transistors. Class A, B, and C amplifiers. Feedback amplifiers and control systems. Multi-vibrators. Transmission lines. Basic communication theory and its practical significance.

PHY317: Basic Experimental Physics V

(1 Units C: LH 15)

Learning Outcomes

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

1. design experiments in the courses taught in the first semester 300 level;

2. acquire data in order to explore physical principles in the courses taught in the first semester 300 level and effectively communicate results; and
3. critically evaluate related scientific studies.

Course Contents

A 3 hour/week laboratory course covering basic experiments illustrative of the 2nd semester, 300 Level Physics Electronics syllabus.

PHY316: Circuit Theory

(2 Units C: LH 30)

Learning Outcomes

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

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

Course Contents

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

PHY325 Measurement and Instrumentation

(2 Units C: LH 30)

Learning Outcomes

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

1. describe mathematically and physically the design in measuring instruments and their use for measurements;
2. design and analyse different types of measuring instruments; and
3. design a variety of electronic instruments and measuring systems used in different fields.

Course Contents

General instrumentation, Basic meter DC measurement. Basic meter in AC measurement, rectifier voltmeter, electro-dynamometer and wattmeter, instrument transformers, DC and AC bridges and their applications, general form of AC bridge, universal impedance bridge, electronic instruments for the measurement of voltage, current, resistance and other circuit parameter, electronic voltmeters, AC voltmeters using rectifiers, electronic voltmeter, digital voltmeters, oscilloscope, vertical deflection system, horizontal deflection system, sampling CRO, instrument for generating and analysing waveforms, square wave and pulse generator, signal generators, function generators, wave analyzers, electronic counters and their applications, time base circuitry, universal counter measurement modes, analogue and digital data acquisition systems, tape recorders.

PHY 399: Industrial Attachment

(3 Units C: 12 weeks)

Learning Outcomes

On completion, the 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 some relevant organisations for additional 12 weeks at the 300

Level for the four (4) year program preferably during the long vacation, and for 24 weeks at the 400 Level for the five (5) year B.Tech. programme during the second semester and the long....

GOU-PHY 309: Artificial Intelligence (2 Units; Compulsory; LH = 15; PH = 45)

Senate-Approved Relevance

Artificial intelligence is the most disruptive technology that have revolutionize our thinking. This course shall acquaint Physics with Electronics students the basic and intermediate knowledge and skillsets in Artificial intelligence. The programming knowledge and skillsets acquired in GOU-PHY 223 and GOU-PHY 224 are prerequisite and the students shall be trained on the techniques in creating hardware and software Artificial intelligence oriented that is capable of solving problems in Physical sciences and engineering. This is in agreement with Godfrey Okoye University's mission and vision to produce Physics with Electronics graduates

that are outstandingly balanced in character and personality; who are proficient in artificial intelligence and ready to join the labour market in companies and industries.

Overview

The application of Artificial intelligence cannot be overemphasized in this present dispensation of digital era. Artificial intelligence is revolutionizing Physics and Engineering research and students should key into Artificial intelligence to acquaint themselves with rudiments involved in data analysis, climate modeling, detection of gravitational waves, etc. Moreover, artificial intelligence technology in integrated circuit can be employed in fault diagnosis, Circuit design optimization, and fabrication of electronic chips (used in Convolutional Neural Network), etc.

Students will apply their acquired knowledge and skillsets in design and construction of robotics and other electronic gadgets that are human and machine based language oriented.

Objectives

The objectives of the course are to;

1. Explain the concepts and techniques of artificial intelligence.
2. Discuss intelligent agents and their performance.
3. Describe the Turing test and the “Chinese Room” thought experiment.
4. Analyze the types of search and their applications in AI.
5. Demonstrate knowledge representation, semantic network and frames along with their applicable uses.
6. Practice Natural Language Processing, translate a natural language.

Learning Outcomes

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

1. Explain AI fundamentals, concepts, goals, types, techniques, branches, applications, and technology.
2. Discuss intelligent agents and their performance.
3. Describe the Turing test and the “Chinese Room” thought experiment, and differentiate between the concepts of optimal reasoning/behaviour and human-like reasoning/behaviour.
4. Describe five roles of heuristics and the trade-offs among completeness, optimality, time complexity, and space complexity.
5. Analyze the types of search and their applications in AI and describe the problem of combinatorial explosion of search space and its consequences.
7. Practice Natural Language Processing, translate a natural language (e.g., English) sentence into a predicate logic statement, etc.
8. Analyze programming languages for AI and expert systems technology, and employ application domains of AI.

Course Content

Overview of Artificial Intelligence (AI). History and Goals AI, and AI Techniques. Types of AI, branches and applications of AI. Advantages and Disadvantages. Agent Performance, Environment and Architectures. Search and general Classes of AI Search Algorithm. Types of

AI Search Techniques and Strategies. Types of problems and techniques in AI. Problem-Solving methods. Major structures used in AI programmes. Knowledge Representation. KR and Reasoning Challenges. KR Languages. Knowledge representation techniques. Semantic Network-types of relationships, semantic network inheritance, types and components. Introduction to Frames. Natural Language Processing (NLP). Introduction to natural language understanding and various syntactic and semantic structures. Introduction to Expert Systems-characteristics, components, types, requirements, technology, development. Programming Languages for AI. Introduction to computer image recognition. **Lab work:** Group practical in (i) Turing test practical-Students can act out their own version of the Turing test (iii) Facial recognition practical to aid in teaching students how machine learning works with students simulating a facial recognition algorithm. Practical applications of NLP in groups – (i) Question Answering focuses on building systems that automatically answer the questions asked by humans in a natural language (ii) Spam detection application for detecting unwanted e-mails getting to a user's inbox (iii) Sentiment analysis/opinion mining should be used on the web to analyse the attitude, behaviour, and emotional state of the sender, implemented through a combination of NLP and statistics (iv) Practical exercise of machine translation used to translate text or speech from one natural language to another natural language such as the Google Translator (v) Developing a model to provide word processor software for the spelling correction (vi) Developing a model for speech recognition for converting spoken words into text (vii) Implementing a Chatbot to provide the staff/student's chat services. OR Group Practical exercise on agents and its environment using simulation of a colony of ants foraging for food; model simulating a message between agents; model simulating the flocking behaviour of birds; model to apply standard search algorithm to the classic search problem of missionaries and cannibals, and how to use communicating agents for searching networks. Some computer AI animation exercises for any branch of AI. Practical exercise on simple robots coupling and programming. Group project of building a lawn robot for trimming grasses, or any simple design and implementation of robotics.

Minimum Academic Standards/Requirements

Classroom, White board and marker, overhead projector, smart board, Laptop, text books on artificial intelligence, instructional materials, programming softwares, programmable circuits/ICs and kits and accessories, IC tester, internet access. Computer systems with capacity to run software systems, Programming environment and tools (e.g., Compilers/interpreters, debuggers, etc. for Java, Python, C+, C++, compiler compilers, e.g., flex, yacc, SableCC, etc.), Operating systems environments and tools (e.g., Windows, LINUX, TempOS, Nachos, Xinu or MiniOS), Tools for systems analysis and design (e.g., Unified Modelling Language (UML)), Power backup. Computer maintenance tools like dust blowers and toolbox, Logic gates, Multiplexers, Digi-Designer Logic Board, Digital Proto-Board, Master-slave flip-flops, ROMs/RAM, Hard drives.

GOU–PHY 324: Computer programming for Physics II (3 Units; Compulsory; LH=30; PH = 45)

Senate -Approved Relevance

This course is aimed at acquainting the students with the intermediate and advanced computer programming knowledge and skillsets. The students will be trained on advanced programming concepts, Class hierarchies and programme organization using packages/name spaces, String processing, searching, sorting, etc, recursive algorithm, graphic user interface, etc., This is in agreement with GOU's mission and vision to empower their graduates with knowledge and skillsets to be outstandingly excellent in character and learning towards applying the acquired knowledge in solving relevant problems in Physics and electronics industries and advancing their career pursuit and advancement in life endeavor.

Overview

Computer programming is the process of writing code to facilitate specific actions in a computer, application or software program and instructing them on how to perform. Computers can do amazing things, from basic laptops capable of simple word processing and spreadsheet functions to incredibly complex supercomputers completing millions of financial transactions a day and controlling the infrastructure that makes modern life possible.

Students trained in GOU-PHY 223 and GOU-PHY324 become computer programmers and they can create instructions for a computer to execute by writing and testing codes that enables applications and software programs to operate successfully. Given this, the students can be a consultants and entrepreneur to numerous electronics/ICT companies and industries.

Objectives

The objectives of the course are to:

1. Develop solutions for a range of problems using object-oriented programming.
2. Use modules/packages/name spaces for programme organization.
3. Use API in writing applications.
4. Write simple multi-threaded applications.
5. Explain divide and conquer strategy to searching and sorting problems using iterative and/or recursive solutions.
6. Explain the concept of exceptions in programming and how to handle exceptions in programmes.
7. Design and implement simple GUI applications.

Learning Outcomes

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

1. Develop solutions to at least five problems using object-oriented programming.

2. Use modules/packages/namespaces for programme organization.
3. Use API in writing two applications.
4. Apply divide and conquer strategy to searching and sorting problems using iterative and/or recursive solutions.
5. Explain the concept of exceptions in programming and how to handle exceptions in programmes.
6. Write simple multithreaded applications.
7. Design and implement three simple GUI applications.

Course Content

This course is a continuation of GOU-PHY223. Review and coverage of advanced object-oriented programming-polymorphism, abstract classes and interfaces. Class hierarchies and programme organisation using packages/namespaces. Use of API – use of iterators/enumerators, List, Stack, Queue from API; Searching; sorting; Recursive algorithms; Event-driven programming: event-handling methods; event propagation; exception handling. Applications in Graphical User Interface (GUI) programming. **Lab work:** Programming assignments leading to extensive practice in problem-solving and programme development with emphasis on object-orientation. Solving basic problems using static and dynamic data structures. Solving various searching and sorting algorithms using iterative and recursive approaches. GUI programming.

Minimum Academic Standards/Requirements

Overhead projector, smart board, Laptop, text books on programming language, internet access, Computer systems with capacity to run software systems, Programming environment and tools (e.g., Compilers/interpreters, debuggers, etc. for Java, Python, C+, C++, compiler compilers, e.g., flex, yacc, SableCC, etc.), Operating systems environments and tools (e.g., Windows, LINUX, TempOS, Nachos, Xinu or MiniOS), Tools for systems analysis and design (e.g., Unified Modelling Language (UML)).

GOU-PHY 331: Renewable energy I (2 Units; Compulsory; LH = 30; PH = 0)

Senate-Approved Relevance

Renewable energy is a source of clean energy supply, and the raw materials like solar radiations, coal and waste products and animal dungs are often available. Harnessing these alternative energy sources for domestic utilization and industrial applications/usages are paramount for economic development. Fossil fuel energy supply is gradually depleting and renewable energy need to be integrated into the National grid energy supply chain for domestic, agricultural, and industrial applications/usages. This course shall acquaint the Physics with Electronics students with the prerequisite knowledge and skillsets in harnessing alternative energy sources. This is in agreement with Godfrey Okoye University's Mission to empower their graduates with knowledge and skillsets to make them outstandingly excellent in their career and/or become self-employed.

Overview

Harnessing alternative energy sources and integrating them into National grid is a penance to epileptic and intermittent power supply in Nigeria. This course introduces the students to different forms of renewable energy sources, and the techniques of harnessing them.

The students employ the techniques of harnessing the alternative energy using local available material, and transform the energy generated for domestic, agricultural and industrial usages.

Objectives

The objective of the course are to:

1. Discuss different alternative energy sources, and their generation.
2. Harness alternative energy.
3. Discuss solar energy and storage systems.
4. Discuss wind energy and its characteristics.
5. Discuss hydro power generations and flow-rate.
6. Discuss energy generation from coal and nuclear materials.

Learning Outcomes

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

1. List at least six different alternative energy sources.

2. Explain chemical processes and energy storage in plant.
3. Explain techniques involved in generation of energy from Solar, Coal and animal dung.
4. Explain solar energy system.
5. Explain different applications of solar energy system.
6. Explain the operations of turbines.

Course Content

Alternative energy sources (Solar, thermal, Wind, Biomass, hydro, coal, nuclear). Solar radiation and measuring instrument. Basic flat plate collector, Selective surfaces anti-reflective coatings, and Collector designs. High density batteries and fuel cells. Solar energy and application. Thermal power generation and energy storage. Biomass energy. Sources of Biomass fuel (wood, animal wastes, etc) and synthesis of fuel. Applications/uses of Biomass energy. Wind energy and power. Characteristics of the wind, estimation of wind speed. Hydro power, principle and flow rate. Impulse and reaction type of turbines. Coal as a source of energy and types. Energy generation and applications/uses of coal. Nuclear materials, energy and application/uses.

Minimum Academic Standards/Requirements

Classroom, White board and marker, overhead projector, Laptop, textbooks on alternative energy sources, instructional materials, internet access, Photocells, Solar batteries, Solar cells, Light meter, coal, prototype turbine engine, Transmission lines.

GOU–PHY 371: Robotic Systems (3 Units; Compulsory; LH = 30; PH = 45)

Senate – Approved Relevance

Robotics is one the disruptive technology in our present day world. GOU-PHY 371 will inculcate in Physics students the basic and intermediate knowledge and skillsets in robotics including the techniques of assembling and test-running robots, programming, interfacing, automation and applications/usage. This is in unison with Godfrey Okoye University's Mission and Vision to produce Physics graduates that are outstanding in character and learning, in creative works, design, programming and construction of robots and high-tech robotic devices.

Overview

A robotics system is a combination of hardware and software components that work together to perform tasks autonomously or with human guidance. The hardware components include sensors, actuators, manipulators, power sources and control systems. The software components include programming languages, algorithms and operating systems. Industrial robots are typically used in manufacturing and production industries to perform tasks such as welding, painting and material handling automation. Service robots are designed to perform tasks in non-manufacturing settings such as healthcare, hospitality and retail. Mobile robots are designed to move around and navigate through environments such as warehouses, hospitals and outdoor settings. Finally, humanoid robots are designed to resemble humans and can be used in a variety of applications such as entertainment and education.

The students will utilize their acquired knowledge and skillsets in assembling robotic parts, write codes and programmes and construct electronic-human interface devices / gadgets.

Objectives

The objectives of this course are to:

1. Define Robotics.
2. Describe the relationship between robotics and artificial intelligence.

3. Explain the processes involved in robotic system design.
4. Differentiate between the hardware and software of a robotic system.
5. Describe the steps in programming a robot.
6. Explain automated manufacturing as a step in robotics system design.
7. Determine the cost of designing and constructing a prototype robotic system.
8. Explain the maintenance process for a robotic system.
9. Design and construct a control system with robotic features.
10. Determine the usefulness of artificial intelligence in robotic systems.

Learning Outcomes

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

1. Explain the meaning and applications of Robotic systems.
2. Define the types of manufacturing systems and their relationship to Robotics and Automated Manufacturing.
3. Explain the major components of robotic systems.
4. Define the function of the robot arm, controller, and power source.
5. Define end-of-arm tooling.
6. Explain all discussed the characteristics of robotic systems.
7. Define the Degree of Freedom, Position Axes, and Orientation Axes.
8. Define Work Envelope.

Course Content

Introduction. Devices and roles in Robotic safety. Classification of robotic systems. Characteristics of Robotic systems. Robotic system design. Arm geometry of robotic systems. Open-loop system. Closed-loop system. Sensors and their uses in robotic systems. End-of-arm tooling. Robotic components. Assembling. Programming. Robotics and Manufacturing systems. Methods of programming in robotics systems. Numbering systems for robotic application. Power ON procedure for robots. Automation. Artificial Intelligence and Robotic System. Robotic applications in different and diverse of life endeavor.

Minimum Academic Standards

Computer hardware workshop with NUC-MAS requirements and facilities.

Learning Outcomes

On completion, the 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 403: Mathematical Methods for Physics I

(3 Units C: LH 45)

Learning Outcomes

On completion, the 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;
4. calculate surface and volume integrals in various coordinate systems;
5. calculate flux integrals and relate them to the divergence and the divergence theorem;
6. calculate line integrals and relate them to the curl and to Stokes' theorem;
7. apply the methods of vector calculus to physical problems; and
8. 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 transform. 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

On completion, the 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 physical applications. Homogeneous partial differential equations.

PHY413: Digital Systems

(2 Units C: LH 30)

Learning Outcomes

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

1. demonstrate a thorough understanding of digital electronics;
2. examine and illustrate the structure of various number systems and its application in digital design;
3. analyse and design various combinational and sequential circuits; and
4. identify basic requirements for a design application and propose a cost effective solution.

Course Contents

Introduction to analysis and design of digital systems. Boolean algebra and mapping methods; Karnaugh and variable-entered maps, combinational logic realization with gates, multiplexers, read only memories (ROMs) and programmable logic arrays (PLAs). State machine analysis and design: state diagrams, state flip-flops, input and output forming logic, gate assignments, redundant states sequential counters, and mainly synchronous systems, state machine, realization with multiplexers, ROMs and PLAs. Asynchronous systems, approach to digital system design; top-down design, trial-and-error methods. Codes, number systems, and arithmetic operations, introduction to computer structures: register transfers, hardware programming methods. Von Neumann machines, and memory systems.

PHY415: Digital Communication Systems

(2 Units C: LH 30)

Learning Outcomes

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

1. explain the principles of digital communication systems;
2. demonstrate in-depth knowledge of various digital modulation schemes; and
3. explain the advantages of digital communication over its analogue counterpart

Course Contents

Block diagram of digital communication system, sampling theorem, Shannon theorem and applications in digital communication system. Advantages of digital signals. Noise in digital signals. Filtering and equalisation. Digital modulation techniques: FSK, ASK, QPSK, M-PSK, QAM, etc. Error detection and correction techniques. Encoders and decoders. Applications of digital communication system: satellite communication, telephoning, microwave, wireless communication, optical communication, broadband communication, internet technology.

PHY417: Advanced Electronics Lab

(1 Units: C PH 45)

Learning Outcomes

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

1. design and implement experiments on advanced analogue circuits;
2. design and implement experiments on digital electronic circuits; and
3. design and implement experiments on microprocessors.

Course Contents

A 6-hour/week laboratory course on selected advanced experiments in analogue and digital electronics circuits taught.

PHY 422: Digital Electronics

(2 Units C: LH 30)

Learning Outcomes

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

1. explain positive and negative logic states, TTL, MOS, CMOS integrated circuit;
2. illustrate the working of flip-flops; and
3. develop skills to build and troubleshoot digital electronics circuits.

Course Contents

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

PHY423: Entrepreneurship in Physics Electronics

(2 Units C: LH 30)

Learning Outcomes

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

1. apply electrical exploration method;
2. demonstrate and apply principles of borehole drilling;
3. operate X-ray machines for medical diagnosis;
4. describe operations and maintenance of MRI machines;
5. design and analyse analogue and digital electronics systems; and
6. apply techniques of troubleshooting in analogue and digital electronics systems.

Course Contents

Electrical resistivity exploration method, principles of borehole geophysics, methods of medical X-ray radiography, techniques of magnetic resonance imaging (MRI), design and analysis of analogue electronics systems, design and analysis of digital electronics systems, methods of troubleshooting in analogue and digital systems, methods of troubleshooting in digital computers.

PHY499: Research Project

(6 Units C: PH 270)

The course enables the student to carry out a specific research project under the supervision of any experienced staff member. Many kinds of problems are acceptable – the only restriction is that the problem shall be a piece of work (experimental or theoretical) which will take about 15% of the student's time during the session and which is judged to be of adequate standard and nontrivial. A departmental committee chaired by the head of department will conduct an oral

examination on the project. The mark will be awarded both on the basis of this report and on his performance at the oral examination.

GOU-PHY 418: Design and Installation of Electrical & ICT Equipment (2 Units; Elective; LH = 15; PH = 45)

Senate-Approved Relevance

Installation of electrical and ICT gadgets and equipment is a lucrative business and this course aim at acquainting the Physics with Electronics students the prerequisite knowledge, techniques, and skillsets needed to be an expert in installation of electrical, electronics, and ICT gadgets/equipment in the offices and industries. This course is fashioned to train the students on how to install and configure internet Router, crimping of internet cable, install radio antenna, server, and internet network. This is in agreement with Godfrey Okoye University's mission to empower their graduates with knowledge and skillsets in order to compete successfully in the labour market and to advance in their career. Moreover, graduates of this course will be proficient in Design and Installation of Electrical & ICT Equipment and become entrepreneurs.

Overview

GOU-PHY 418 is paramount for Physics with Electronics students to acquire knowledge and skillsets in design and installation of electrical, electronics, and ICT gadgets/equipment. This course will predisposed them to the rudiments involves in design and installation of electrical/electronic and ICT gadgets in Information and telecommunication companies. Moreover, GOU-PHY 418 is one of the fundamental course for any Physics with Electronics graduates who wish to advance his/her career in Electronic engineering, and information and communication technologies.

GOU-PHY 418 will equip Physics with Electronics students with knowledge and skillsets to secure job in Electricity distribution companies, commercial Banks, information and telecommunication companies as well as other private and government sectors that utilize electronics and ICT gadgets. Moreover, An expert in design, installation of electrical, electronics, and ICT gadgets and equipment is an entrepreneur and can be a consultant to ICT firm and industries.

Objectives

The objectives of the course are to:

1. Discuss the health and safety standards in installing electrical and electronic/ICT gadgets.
2. Discuss the NCC and FCC codes of practice and standards.
3. Implement telecommunication design and installations.
4. Configure computer network and install Telephone equipment.
5. Install electrical and ICT equipment.

Learning Outcomes

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

1. Describe Health and safety standards in electrical installations.
2. Explain NCC and FCC codes of practice and standards in Nigeria.
3. Implement Telecommunication design and installation.
4. Configure computer networks.
5. Design and install Telephony equipment.
6. Install electrical, electronics and ICT equipment.

Course Content

Electrical Installation. Introduction to Health and safety at Work Act in Nigeria. Electrical safety and First aid. Electricity supply regulations. Lighting, Illumination and Maintenance factor. Coefficient of utilization. Types of light sources and calculation of lighting requirements. Glare and Stroboscopic effect. Installation Materials (cables, junction box, terminations, joints, Conduits and conduiting, Trunks and trunking). Electrical Installation design (in domestic, commercial, and industry). Alarm and emergency systems. Earthing, Protection and Purposes of earthing (Faraday cage. Rod electrodes. Earth electrode resistance. Earthing system. Earth fault loop impedance). ICT services: NCC and FCC codes of practice and standards. Telecommunication design and installation (Satellite, VSAT, etc). Telephone design and installation. Computer networking design and installation. Wireless LAN design and installation. Preparation of Bill of Engineering Measurement Evaluation. Contract bidding. Consultancy. **Lab Work:** Demonstration of simple electrical installations using electrical materials including conduits and trunks. Illustration of ICT installations including wired and wireless computer networks. Demonstration of telecommunications installations.

Minimum Academic Standards/Requirements

Classroom, White board and marker, overhead projector, Laptop, text books on computer networking, ICT gadgets and installation as well as Electrical and electronic engineering,

internet access. Light meter, Electronic tools. Computer systems (hosts running LINUX or Windows), Routers, Switches, Radio modems, etc., Dialup modems and PABXs, Patch panels, Simulation software like Packet tracer, NS Simulator or others, LAN testers, crimping tools, etc., Practical consumables (RJ-45 connectors, twisted pair cable, etc.)

NB: we will liaise with the Computer science and ICT unit of the University.

GOU-PHY 423: Nuclear Physics (3 Units; Compulsory; LH = 45; PH = 0)

Senate-Approved Relevance

Nuclear energy is an alternative source of energy and nuclear materials like Uranium deposit in some part of Nigeria (Zamfara, Jos, etc) is evidenced. Therefore, harnessing this energy is paramount because 2 atomic mass unit (amu) of Uranium can generate mega electron-volt (MeV) of energy capable of powering many household when proactive measure to prevent energy loss is taken care off. GOU-PHY 423 will acquaint Physics with Electronic students the techniques of Nuclear energy generation using Einstein's mass-energy equation. Techniques of nuclear reactor design and construction, nuclear instrumentation, radiation hazards and Health protection will be extensively discussed. Given this, This course intend to produce Physics with Electronics graduates who will be outstandingly excellent in learning, character and personality as well as being proficient in Nuclear Physics and energy, nuclear reactor design technique and nuclear research. This is in agreement with Godfrey Okoye University's to empower graduates with knowledge and skillsets needed for further study and career advancement.

Overview

This course expose students to the nuclear structures and models, concept of nuclear reactions. Stable and unstable atoms. Radioactivity and uses/applications. Nuclear reactions; artificial and natural. Basic reactor physics, Moderators and properties. Interaction of nuclear radiations with matter. Nuclear instrumentation and radiation protections. This course also explains the concept of nuclear energy generation, transmission, distribution, and applications as well as particle accelerators. Nuclear energy is generated from the nucleus of nuclear material (such Uranium,

Radon, etc.) inside a nuclear reactor. Moderators are often used to speed-up or slow-down the reactions.

The students will be acquainted with the knowledge and technical skillsets on instrumentation in Nuclear Physics, energy generation and distribution. The students will develop a nuclear reactor model and explain the working principles/mechnaisms.

Objectives

The objectives of the course are to;

1. Discuss nuclear materials available in some states in Nigeria.
2. Discuss stable and unstable atoms.
3. Discuss mass defect and binding energy.
4. Discuss nuclear reactions, energy generations and uses.
5. Discuss different nuclear models.
6. Discuss nuclear particles and their properties.
7. Discuss nuclear reactions, radioactivity and their applications/uses.
8. Discuss Nuclear reactors and characteristics of moderators.
9. Discuss nuclear instrumentation.
10. Discuss nuclear radiations protection and control.

Learning outcomes

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

1. Enumerate eight nuclear materials.
2. Differentiate between stable and unstable atoms.
3. Calculate binding energy from mass defect.
4. Explain radioactivity and its application.
5. Discuss four nuclear reaction moderators and their properties.
6. Explain five nuclear particles and their properties.
7. Explain four different nuclear models.
8. Explain two nuclear reactions and energy generations.
9. Explain nuclear radiation protection and control.
10. Explain Nuclear reactor design.

Course content

Basic nuclear concepts. Nuclear materials. Nuclear structure. Nuclear energy. Binding. Stability. Nuclear forces. Nuclear reactions; Fission and Fusion. Thermonuclear energy. Cross sections. Theory of beta decay. Various nuclear models. Nuclear fusion-thermo-nuclear reactions. Radioactivity. Nuclear radiation interaction with matter. Nuclear instrumentation. Radiation protection and control. Reactor physics; chain reactions. Thermalization of neutrons. Moderators; properties and basic interpretations. Slowing down of neutrons in media-neutron induced chain reactions. Basic reactor designs-light and heavy water reactors. Molten salt breeder reactors. High temperature gas cooled reactors. Power plant thermodynamics. Reactor heat generation and removal. Basic plasma physics. magnetohydrodynamic equations. Particle detectors. High energy accelerators.

Minimum Academic Standards

Classroom, White board and marker, overhead projector, Laptop, text books on Nuclear Physics and Energy, internet access. Instructional materials. Nuclear reactor prototype. Internet access.

GOU-PHY 452: Remote Sensing (2 Units; Elective; LH = 30; PH = 0)

Senate-Approved Relevance

The rate of security threat, insurgence, incessant bush burning, fire outbreak incidence and hazards in Nigeria is quit alarming. Analog and digital sensors and other electronic components can be utilized to construct a robust electronic gadget that can be attached to a drone for surveillance, monitoring, and tracking fire disaster, earth quake and other environmental disasters. This course train the students on techniques of creating analog-to-digital interface, and construction of monitoring device that can track fire outbreak and other environmental disasters that pose a big threat to human life. This is in unison with Godfrey Okoye University's Mission to empower their graduates with knowledge and skillsets to make them outstanding and excellent in character and learning as well as creativity, innovation and enterprise.

Overview

The role of remote sensing in surveillance, monitoring, and tracking fire disaster, earth quake and other environmental disaster cannot be overemphasized. This course intended to train the students on techniques in remote sensing and techniques of constructing a monitoring device

using available sensor. The diverse applications of remote sensing in meteorology, geology, agriculture, forestry, urban studies, and oceanography would be extensively discussed.

The students can use local available electronic components to construct a robust electronic gadgets that can be used to monitor fire outbreak.

Objectives

The objectives of the course are to:

1. Define remote sensing.
2. Discuss basis of remote sensing.
3. Explain radiation characteristics of natural phenomena.
4. Collect data from sensor platform, processes the data and interpretation.
5. Discuss the applications of remote sensing techniques in meteorology, Geology, Agriculture, etc.

Learning Outcomes

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

1. Define remote sensing and explain the physical basis of remote sensing.
2. Collect data from the remote sensing platform.
3. Analyze the data and interpret it.
4. Discuss extensively the applications of remote sensing in Agriculture.
5. Discuss uses/application of remote sensing in meteorology.
6. Discuss uses/application of remote sensing in forestry, etc.

Course content

Definition of remote sensing. Physical basis of remote sensing. Radiation characteristics of natural phenomena. Types of sensors. Sensor for monitoring the environment (passive and active system). Data collections platforms. Sensor packages (Landsat and SPOT systems). Manual and automatic data processing. Data analysis. Interpretations. Applications of remote sensing techniques in meteorology. Remote sensing techniques in geology. Remote sensing techniques in agriculture. Remote sensing techniques in forestry. Remote sensing techniques in urban studies, and oceanography, etc..

Minimum Academic Standards

Classroom, White board and marker, overhead projector, Laptop, text books on Remote sensing, electronic components, analog and digital sensors, Logic gates, bread boards, Vero board, instructional materials, programmable circuits/ICs and kits and accessories, internet access.

GOU-PHY 488: Renewable energy II - Biomass, Coal, and Photo-voltaic (2 Units; Compulsory; LH = 15; PH = 45)

Senate-Approved Relevance

Biomass, Coal, and Solar radiations are the most abundant sources of alternative energy in Enugu. Harnessing energy from these sources will go a long way to reduce the impact of epileptic and intermittent power supply in Enugu state. Energy generation from these sources/ materials and distribution is feasible and achievable. This course train the Physics with Electronics students on the techniques on how to extract heat/thermal energy from animal dung and coals for domestic purposes like cooking. Solar radiations from the Sun can be

trapped using solar panel and be converted electrical energy that can be used for domestic, agricultural, and industrial purposes. This course is fashioned in line with the Mission, Vision and Philosophy of Godfrey Okoye University towards producing Physics with Electronics graduates who will be experts and excellent on alternative means of energy generation and distribution basically on the Biomass energy, Coal and photo-voltaic system.

Overview

This is an advanced course of GOU-PHY 331 and it focuses on the harnessing the energy from coal, Biomass and Solar. Harnessing these alternative energy in our locality is paramount to drastically reduce the effects of epileptic and intermittent power supply. The students would be trained on the techniques of generation of energy from animal dung, ethanol and vegetation. Solar cell construction and PV system will be extensively discussed.

The students should be able to harness energy from the alternative energy sources using local available materials, and install solar energy system for domestic and industrial uses.

Objectives

The objective of the course are to;

1. Discuss different between Biomass and Photo-voltaic systems, and their generation.
2. Discuss solar energy and storage systems.
3. Discuss Biomass energy generation and storage.
4. Discuss photo-voltaic (PV) technologies and applications.
5. Discuss current-voltage and power-voltage characteristics.
6. Discuss Biomass power plant and energy distribution.
7. Discuss the applications of photo-voltaic system in industries and agriculture.
8. Discuss coal mining techniques and processing.
9. Discuss coal utilization and environment.

Learning Outcomes

On the completion of this course students should be able to;

1. Enumerate different sources of Biomass materials.
2. Classify bio-fuel.
3. Explain techniques involved in generation of energy from animal dung.
4. Explain PV technology and solar energy system.

5. Explain at least five applications of solar energy system.
6. Explain five application/uses of Biomass.
7. Explain coal mining technique and processing.
8. Coal utilization and environmental impacts.

Course Content

Biomass as a source of energy. Bio-fuel classification. Combustion of solid biomass (production of gaseous and liquid fuels from biomass anaerobic digestion, Fermentation for ethanol and vegetable oils for bio-diesel; Municipal solid waste; MSW). Biomass energy generation and usage/application. Classifications of coal and source of a fuels. Coal mining and processing techniques. Coal efficient combustion techniques. Coal as source of petrochemicals/raw materials. Fischer-Tropsch process; coal utilization and the environment. Photo-conductivity in solids. Photo-voltaic cells and voltage and current generation. Current-voltage and power-voltage characteristics. Amorphous photo-voltaic cells (PVCs) and energy storage. Design, performance and economics of solar photo-voltaic systems. Measurement and instrumentation for photo-voltaic system. Components of photo-voltaic system. Installation of photo-voltaic systems. Application/uses of photo-voltaic for domestic, industrial and Agricultural purposes.

Minimum Academic Standards/Requirements

Classroom, White board and marker, overhead projector, Laptop, textbooks on Biomass, Coals, and Photo-voltaic technology, instructional materials. Internet access. Photocells, Solar batteries, Solar cells, solar panel, inverter, coal, Transmission lines, etc.

Minimum Academic Standards

Equipment

i) Electrical and Electronics

S/No	Equipment
1.	Functional fire extinguisher
2.	Well-equipped first aid box
3.	Resistance boxes
4.	Meter Bridges
5.	Potentiometers
6.	KOH Electrolytes

7.	Frank Hertz power supply
8.	Power supply 4.5 VDC 0.3A
9.	Universal plug boards
10.	Hofmann Volt meters
11.	Photocells
12.	Electric field meters
13.	Magnetic compasses (38mm)
14.	Magnetic compasses (18mm)
15.	Gamma detectors
16.	Solar batteries (2u d = 80mm)
17.	Thermopiles
18.	Electrodes (zinc rod)
19.	Multimeters
20.	Charge mass ratio equipment
21.	Leyden Jar
22.	Galvanometers
23.	Resistors
24.	Electronics kit
25.	Connection box (06030.20)
26.	Ultrasonic pickups
27.	Electroscope (rectangular case)
28.	Gold leaf electroscopes
29.	Friction ebonite rods
30.	Polythene rods
31.	Flint glasses
32.	Insulating glasses
33.	Discharger electrostatics
34.	Vac bipolar junction transistorsuum tube diodes
35.	Nylon rod
36.	Nylon lacing cord
37.	Teslameter with 2 probes
38.	Potentiometer 100Q
39.	Transistors,
40.	Diodes
41.	Operational amplifiers

S/No	Equipment
42.	Analog ICs
43.	Soldering irons
44.	Oscilloscopes
45.	Capacitors
46.	Inductors

47.	Solar cells
48.	Logic gates
49.	Programmable logic gates
50.	Microprocessors
51.	Registers
52.	ROMs
53.	RAMs
54.	Connection wires
55.	Amete3A Ac, D _c
56.	Voltmeter moving coil 0-10 _v
57.	Voltmeter 2 Cale 10 - 5 _v , 0 - 15 _v
58.	Ammeter moving coil 0-2 5A
59.	Shunt 0-10A D _c
60.	Shunt 0 -10 M _A
61.	Rheostats 33 Ω(3.1A)
62.	Bread boards
63.	Antenna test bench
64.	Horn antenna
65.	Gunn diode power supply
66.	Induction coils 150 TURNS, D25mm
67.	Induction coils 300 TURNS, D25mm
68.	Induction coils 300 TURNS, D33mm
69.	Induction coils 100 TURNS,D40mm
70.	Digital oscilloscopes
71.	GM TUBES
72.	GM TUBE holder & lead
73.	Electro mag. induction apparatus
74.	Demonstration induction coils
75.	Coil tapped 140 turns
76.	Oscilloscopes
77.	Function generators
78.	Transformer stand & core
79.	U-cores
80.	Transmission lines
81.	Signal generators
82.	Breadboards
83.	Stripboards
S/No	Equipment

84.	Platinum electrodes
85.	Vacuum tubes

ii) Optics, Acoustics and Special Experiments Laboratory

S/No	Equipment
1.	GM TUBEs
2.	GM TUBE holder & lead
3.	Spectrometer intermediate
4.	Screen metal 300x300mm
5.	Screen translucent 250x250mm
6.	Organ pipe - Open C
7.	Turning forks box
8.	Sonometer wood board
9.	Turning forks C- motor scale
10.	Optical bench model A
11.	Resonance tube apparatus
12.	Turning for'ks2000h2
13.	Turning forks mounted with harmer
14.	Sonometer wood board x EL-340L
15.	Sonometer wire
16.	Turning forks 1700 H ₂
17.	Turning forks 1000 H ₂
18.	Stricking harmmer rubber
19.	Turning forks C Masor scarce
20.	Experiment lamps 5
21.	Ware machine
22.	Stroboscope hand
23.	Narrow beam tube
24.	Ripple tank assembly
25.	Power supply for CS 150w
26.	Power supply for spectral lamps
27.	Stroboscope motor driven
28.	Power supply for ripple tank
29.	Lamp transformer GV AC
30.	Control transformer
31.	Spectrum tube neon
32.	Quiet holder 85x100mm

33.	Optical bench 500mm zesis
34.	Diaphram holder
35.	Fresnel mirror
36.	Steel rail, pentagon section
37.	Optical shutter
38.	Holder for mirror wooden
39.	Lens holder wood v-shape

S/No	Equipment
40.	Lens holder universal
41.	Object holder 50x50mm
42.	Lens holder 08012.00
43.	Newtons rings apparatus j
44.	Slit objectable 08049.00
45.	Slide mounted for zesis bench
46.	Slide mounted lateral adjust
47.	Slide mounted exten. for zesis bench
48.	Slide mount lateral adj. 08082.00
49.	Slide mount for zesis 60/30mm
50.	Slide mount for zesis 60/46mm
51.	Slide mount forpPentagon section
52.	Experiment lamps 308143.00
53.	Holder for steel rails
54.	Swinging arm 08256.00
55.	Socket wrench for slide mount
56.	Mercury discharge lamp 24-OV
57.	Na lamp 220 - 200V AC
58.	Laser He - Ne 1.0mm, 220V AC
59.	Experiment lamp 08141.00
60.	Hydrogen discharge tube
61.	Argon tube
62.	Spectrum tube neon
63.	Spectral lamp zinc (2N)
64.	Spectral lamp Ha
65.	Spectral Lamp He
66.	Spectral Lamp Cd
67.	Spectral Lamp Na, Pico
68.	Spectral Lamp Ne,

69.	Connecting hinge for zesis
70.	Double slits kit
71.	Lamp holder 08119.00
72.	Shank screw for zesis
73.	Extension tube 08131.02
74.	Plate holder 02063.00
75.	Interference filter, Set of 3
76.	Lycopodium powder
77.	Student microscope 150mrn scales
78.	Camera shutter with Iris diaphiapien scope
79.	Critical angle apparatus
80.	Telescope model telestial
81.	Astronomical telescope
S/No	Equipment
82.	White screen XEL760C
83.	Kundes tube, apparatus
84.	Light meter, exposume meter
85.	Table top on stand
86.	Concave, convex and plane mirrors
87.	Hollow glass L 60°, 60°, 60°
88.	Prism table with prism
89.	Glass prision L90°. 45°. 45°. 32 x 50mm
90.	Rect. glass block, 114x63x19mm
91.	Prison 60° L = 30mm Crown
92.	Prison 60° L = 30mm Flint
94.	Lens mounted F = + 50mm
95.	Lens mounted F = - 50mm
96.	Lens mounted F = 200mm
97.	Prisimtable with holder
98.	Iris diaphram
99.	Double condenser F = 60mm
100	Functional fire extinguisher
101	Well-equipped first aid box

iii) General Physics Laboratory

S/No	Equipment
1.	Spherometer
2.	Overhead projector
3.	Spirit level
4.	Weighted glass bulb
5.	Aquarium pump
6.	Heating apparatus (for high vapour pressure)
7.	HIGH PRASAHERA (vapour unit)
8.	Weighing Bridge (130x50x50 mm)
9.	Watch glass (30 mm)
10.	Watch glass (100 mm)
11.	Youngs modulus
12.	Aquarium pump (220V AC)
13.	Gas syringe
14.	Precision manometer
15.	Glass beakers (1000 ml)
16.	Glass beaker
17.	Glass beakers (600 ml)
18.	Glass beakers
19.	Flask, flat bottom (050 ml)

S/No	Equipment
20.	Glass beakers (400 ml)
21.	Glass beaker (100 ml)
22.	Cork borers (4-10 mm bores)
23.	Cork borers (4-18 mm bores)
24.	Charle's law app.
25.	Leslie cube
26.	Air thermometer (constant volume)
27.	Air thermometer (constant volume)
28.	Funnel (plain soda lime glass 70 mm)
29.	Fly wheel (200 mm)
30.	Bench vice
31.	Graduated cylinder
32.	Glass beads (6 mm)
33.	Conductivity app. (EDSER)
34.	Trolley (two trays)

35.	Thermometer (5-500C
36.	Bunsen burner
37.	Thermometer
38.	Thermometer (Max/Min. Six's Pattern)
39.	Hygrometer (regnault single
40.	Specific gravity bottle
41.	Bearing brass head
42.	Bearing brass head
43.	Laboratory jack
44.	Calorimeter (Joule Aluminum, LV)
45.	Calorimeter (continuous flow)
46.	Ice calorimeter
47.	Slotted rack
48.	Hydrometer 1-00-1-50
49.	Spring balance phywe
50.	Wash bottle plastic
51.	Micrometer screw gauge
52.	Scale pan (Plastic)
53.	Univ. bending machine
54.	Spring balance mech. 0-500g
55.	Spring balance flat 0 – 1000g
56.	Gas syringe holder
57.	Metal cubes
58.	Spring balance 200 x 3g
59.	Electronic balance
60.	Geometric equivolume
61.	Vernier caliper gauge (17cm x 6)(18
62.	Water distillers
63.	Barometer fortin
S/No	Equipment
64.	Connecting tube (heat condi copper)
65.	Torsion apparatus
66.	Gas law apparatus
67.	Vernier caliper 0 -12 cm
68.	Spring balance 0 - 200g
69.	Spring balance 0 – 100g
70.	Crystallizing dish 190 mm
71.	Pipette as kci. 5 ml

72.	Mercury tray wooden
73.	Mat
74.	Three limb tube (U -tube & Hares app.)
75.	Glass tube
76.	Torque
77.	Scale pam light alloy
78.	Pollygon of Forcds??? App.
79.	U –tube
80.	Fylctal cylinder (Set of 6)
81.	Iron cylinder
82.	Metal cylinder (Set of 3)
83.	Pendulum bob
84.	Meter rules
85.	Half meter rules
86	Functional fire extinguisher
87	Well-equipped first aid box

iv) Workshop

S/No	Equipment
1.	Basic hand tools
2.	Workbench
3.	Hand machines
4.	Drilling machine
5.	Lathe machine
6.	Vises
7.	Functional fire extinguisher
8.	Well-equipped first aid box
9.	Welding equipment

Staffing

Academic Staff

The guidelines on academic staff/student ratio of 1:20 for Science Programmes shall apply. To start any programme in Science, there should be a minimum of six academic staff. There is need to have a reasonable number of staff with PhD degrees accounting for at least 70% of the total number and having adequate teaching experience for every programme in the Discipline.

Administrative Support Staff

The services of the administrative support staff are indispensable in the proper administration of the Department. It is important to recruit very competent, computer literate senior staff.

Technical Support Personnel

The services of technical support staff, which are indispensable in the proper running of laboratories are required. It is important to recruit very competent senior technical staff to maintain teaching and research equipment. They are also to undergo regular training to keep them abreast of developments in equipment operation and maintenance.

Classrooms, Laboratories, Workshops and Office

Space The NUC recommends the following physical space requirements:

Description		Size m²
Professor's Office	-	18.50
Head of Department's Office	-	18.50
Tutorial Teaching Staff's Office	-	13.50
Other Teaching Staff Space	-	7.00
Technical Staff Space	-	7.00
Secretarial Space	-	7.00
Research Laboratory	-	16.50
Seminar Space/per student	-	1.85
Laboratory Space per FTE	-	7.50
Conference Room	-	37.0

The Head of Department office has a toilet attached to it. The department should be provided with at least:

1. Four (4) large laboratories calculated according to specifications of 7.5 m² per FTE; a minimum of four (4) preparatory rooms for each laboratory at the NUC specifications of 7 m² each.
2. At least two lecture rooms capable of sitting at least sixty students at the specification of 1 m² per FTE.
3. A departmental conference room.
4. A staff common room.

Library

Universities should leverage on available technology to put in place rich databases and other electronic/digital library and information resources. In addition, well stock and current hardcopies of reference and other textual materials should be provided centrally at the level of the faculty. A well network digital library should serve the entire university community. Availability of wireless facilities (Wifi) with adequate bandwidth should enhance access to these electronic resources. In any

case, there should be internet-ready workstations available in the library for at least 25% of the total student enrolled in each academic programme. The funding of the library should be in line with NUC guidelines.