GODFREY OKOYE UNIVERSITY
ENUGU, ENUGU STATE, NIGERIA
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B. SC BIOCHEMISTRY

The Core Curriculum Minimum Academic Standards (*CCMAS*)

September, 2023.

Overview

Biochemistry programme is designed to enable graduates acquire broad based knowledge on chemical processes in living organisms ranging from single to multi- cellular organisms, both plants and animals. The first year of the programme is designed to prepare the students to acquire sound background knowledge of relevant science subjects, which would be a foundation to prepare them for specialized knowledge of Biochemistry. During the second and third year, the programme will expose the students to fundamental constituents (macro and micro) that constitute life processes and their dynamics. This will prepare them to appreciate the consequences of various deviations from normal during the final year.

Philosophy

Biochemistry programme provides broad based education that explains chemical processes that take place in living organisms and the causes of various deviations, which can invariably lead to pathological conditions. It also provides basis for manipulation of normal processes to achieve desired outcome. Products of the programme will be suitable for employment in health, food and related industries. They can also be self- employed.

Objectives

The main objectives of the degree programme in biochemistry would be to:

1. provide students with a broad and balanced foundation of biochemical knowledge and practical skills;
2. develop in students the ability to apply knowledge and skills to solving theoretical and practical problems in biochemistry;
3. develop in students, a range of transferable skills that are of value in biochemical and nonbiochemical employment
4. provide students with knowledge and skills base from which they can proceed to further studies in specialised areas of biochemistry or multi-disciplinary areas involving biochemistry;
5. provide, through training and orientation, an appreciation of the rewards of inter- and multidisciplinary approach to the solution of complex life problems; and
6. generate in students an appreciation of the importance of biochemistry in industrial, economic, environmental, technological and social development.

Unique Features of the Programme

The unique features of the programme include:

1. development, in the students, of high cognitive abilities and skills related to biochemistry and other life sciences;
2. students would be introduced to properties of flora and fauna, which are abundant in the tropics that may enable their use as candidates for drug development;
3. graduates would be capable of exhibiting practical skills in biochemistry, including knowledge of safety issues in laboratories and instrumentation;
4. graduates would be able to develop scientific information literacy skills to support independent learning and industrial knowledge; and
5. graduates would be able to demonstrate critical thinking skill to solve problems relating to biochemistry and other life sciences.

Employability Skills

1. Graduates would be familiar with various biochemical processes used in industries.
2. They will imbibe a sense of enthusiasm for biochemistry as central to other life sciences.
3. Appreciation of biochemical application in different other related fields.
4. They can be self-employed by establishing relevant small and medium scale enterprises.

21st Century Skills

1. Critical thinking, problem solving, reasoning, analysis, interpretation and synthesizing information.

2. Predictability skills without using live specimen.
3. Creativity, imagination, innovation and personal expression.
4. Research skill and practices and interrogative questioning.
5. Oral and written communication.
6. ICT literacy, data interpretation and analysis.

Admission and Graduation Requirements

Admission Requirements

1. The entry requirements for a four-year degree programme shall be senior secondary certificate (SSC) credit passes (WASC; NECO or equivalent) in five subjects at not more than two sittings. Such subjects shall include English language, Mathematics, Biology, Chemistry and Physics. In addition, an acceptable pass in the Unified Tertiary Matriculation Examination (UTME) is required for admission into 100 Level.
2. Candidates with five SSCE (or equivalent) credit passes with at least two at the GCE Advanced Level or IJMB or JUPEB in Biology and Chemistry, 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
GST 111	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 Science	3	C	30	45
BIO 101	General Biology I	2	C	30	-
BIO 102	General Biology II	2	C	30	-
BIO 107	General Biology Practical I	1	C	-	45
BIO 108	General Biology Practical II	1	C	-	45
CHM 101	General Chemistry I	2	C	30	-
CHM 102	General Chemistry II	2	C	30	-
CHM 107	General Chemistry Practical I	1	C	-	45
Course Code	**Course Title**	**Unit(s)**	**Status**	**LH**	**PH**
CHM 108	General Chemistry Practical II	1	C	-	45
PHY 101	General Physics I	2	C	30	-
PHY 102	General Physics II	2	C	30	-
PHY 107	General Physics Practical I	1	C	-	45
PHY 108	General Physics Practical II	1	C	-	45
	Total	**29**			

200 Level

Course Code	Course Title	Unit(s)	Status	LH	PH
GST 212	Philosophy, Logic and Human Existence	2	C	30	-
ENT 211	Entrepreneurship and Innovation	2	C	15	45
BCH 201	General Biochemistry I	2	C	30	-
BCH 202	General Biochemistry II	2	C	30	-
BCH 203	General Biochemistry Practical	1	C	-	45
STA 221	Statistics for Agriculture & Biological Sciences	3	C	45	-
GOU-BCH 204	Process Biochemistry	2	C	30	-
GOU-BCH 205	Soil Biochemistry	2	E	30	-
GOU-BCH 206	Tropical Medicinal Plants	2	C	30	-
GOU-BCH 207	Microbial Biochemistry	2	C	30	-
	TOTAL	20			

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
BCH 301	Enzymology	2	C	30	-
BCH 302	Metabolism of Carbohydrates	2	C	30	-
BCH 303	Metabolism of Lipids	2	C	30	-
BCH 304	Metabolism of Amino Acids & Proteins	2	C	30	-
BCH 305	Metabolism of Nucleic Acids	2	C	30	-
BCH 306	Analytical Methods in Biochemistry	3	C	30	45
BCH 307	Membrane Biochemistry	2	C	30	-
BCH 308	Bioenergetics	1	C	15	-
BCH 309	Inorganic Biochemistry	1	C	15	-
BCH 399*	Industrial Attachment	3	C	-	12 Weeks
GOU-BCH 310	Molecular Basis of Infectious Diseases	2	C	30	-
GOU-BCH 311	Computational Biochemistry	2	C	15	45

GOU-BCH 312	Tropical Plants-based Drugs for Disease Management	2	C	30	-
GOU-BCH 313	Immunology and Immunochemistry	2	E	30	-
	TOTAL	32			

***** To take place during the long vacation between 300 and 400 Levels **400 Level**

Course Code	**Course Title**	**Unit(s)**	**Status**	**LH**	**PH**
BCH 401	Advanced Enzymology	2	C	30	-
BCH 402	Molecular Biochemistry	2	C	30	-
BCH 403	Metabolic Regulations	2	C	30	-
BCH 404	Biochemical Reasoning	1	C	15	-
BCH 405	Plant Biochemistry	2	C	30	-
BCH 406	Research Project	6	C	-	270
BCH 407	Bioinformatics	2	C	30	-
BCH 408	Biochemical Entrepreneurship	2	C	30	-
GOU-BCH 409	Biochemical Application in Forensic Science	2	C	30	-
GOU-BCH 410	Molecular Docking	2	C	15	45
GOU-BCH 411	Cellular and Molecular Neuroscience	2	C	30	-
GOU-BCH 412	Nutrigenomics and Nutrigenetics: the emerging frontiers in nutrition	2	C	30	-
GOU-BCH 413	Genetic Engineering and Biotechnology	3	C	30	45
GOU-BCH 414	Biochemical Pharmacology and Toxicology	2	E	30	-
GOU-BCH 415	Nanoscience and Nanotechnology	2	C	30	-
GOU-BCH 416	Biostatistics	2	C	15	45
GOU-BCH 417	Environmental Chemistry and waste management	3	C	45	-
	TOTAL	39			

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 and collocations). Sentence in English (types, structural and functional, simple and complex). Grammar and usage (tense, mood, modality, concord and 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 and 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 and colonial administration of Nigeria). Evolution of Nigeria as a political unit (amalgamation of Nigeria in 1914, formation of political parties in Nigeria, nationalist movement and struggle for independence). Nigeria and challenges of nation building (military intervention in Nigerian politics and Nigerian Civil War). Concept of trade and economics of self-reliance (indigenous trade and market system, indigenous apprenticeship system among Nigeria people, trade, skill acquisition and self-reliance). Social justices and national development (law definition and classification. judiciary and fundamental 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.

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 the various types of numbers; and 5. solve some problems using binomial theorem.

Course Contents

Elementary set theory, subsets, union, intersection, complements and venn diagrams. Real numbers, integers, rational and irrational numbers, mathematical induction, real sequences and series, theory of quadratic equations and binomial theorem. Complex numbers, algebra of complex numbers and 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 and definite integrals. Application to areas and volumes.

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

Learning Outcomes

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

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

Course Contents

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

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

BIO 101: General Biology I **(2 Units C: LH 30)**

Learning Outcomes

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

1. explain cell structure and organizations;
2. summarize functions of cellular organelles;
3. characterize living organisms and state their general reproduction;
4. describe the interrelationship that exists between organisms; 5. discuss the concept of heredity and evolution; and

6. enumerate habitat types and their characteristics.

Course Contents

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

BIO 102: General Biology II **(2 Units C: LH 30)**

Learning Outcomes

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

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

Course Contents

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

BIO 107: General Biology Practical I **(1 Unit C: PH 45)**

Learning Outcomes

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

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

Course Contents

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

BIO 108: General Biology Practical II **(1 Unit C: PH 45)**

Learning Outcomes

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

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

Course Contents

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

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

Learning Outcomes

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

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

Course Contents

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

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

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

Course Contents

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

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

Learning Outcomes

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

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

Course Contents

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

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

Learning Outcomes

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

1. identify the general laboratory rules and safety procedures;
2. collect scientific data and correctly carry out chemical experiments;
3. identify the basic glassware and equipment in the laboratory;
4. identify and carry out preliminary tests which includes ignition, boiling point, melting point, test on known and unknown organic compounds;
5. execute solubility tests on known and unknown organic compounds;

6. execute elemental tests on known and unknown compounds; and
7. conduct functional group/confirmatory test on known and unknown compounds which could be acidic/basic/neutral organic compounds.

Course Contents

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

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

Learning Outcomes

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

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

Course Contents

Space and time. units and dimension. vectors and scalars. differentiation of vectors: displacement, velocity and acceleration. Kinematics. Newton laws of motion (Inertial frames, Impulse, force and action at a distance, momentum conservation). relative motion. Application of Newtonian mechanics. equations of motion. conservation principles in physics, conservative forces, conservation of linear momentum, Kinetic energy and work, Potential energy, System of particles, Centre of mass. Rotational motion. torque, vector product, moment, rotation of coordinate axes and angular momentum, 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 of the course, students should be able to:

1. describe the electric field and potential and related concepts, for stationary charges;
2. calculate electrostatic properties of simple charge distribution 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, current, voltage and resistance, Ohm's law and 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, resistance and combinations.

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

Learning Outcomes

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

1. conduct measurements of some physical quantities;
2. make observations of events, collect and tabulate data;
3. identify and evaluate some common experimental errors;
4. plot and analyse graphs; and
5. draw conclusions from numerical and graphical analysis of data.

Course Contents

This introductory course emphasizes quantitative measurements, 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 and viscosity covered in PHY 101. However, emphasis should be placed on the basic physical techniques for observation, measurements, data collection, analysis and deduction.

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

Learning Outcomes

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

1. conduct measurements of some physical quantities;
2. make observations of events, collect and tabulate data;
3. identify and evaluate some common experimental errors;
4. plot and analyse graphs; and
5. draw conclusions from numerical and graphical analysis of data.

Course Contents

This introductory course emphasizes quantitative measurements, 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 and many more, covered in PHY 102. However, emphasis should be placed on the basic physical techniques for observation, measurements, data collection, analysis and deduction.

200 Level

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

Learning Outcomes

A student who has successfully gone through this course should be able to:

1. know the basic features of philosophy as an academic discipline;
2. identify the main branches of philosophy & the centrality of logic in philosophical discourse;
3. know the elementary rules of reasoning;
4. distinguish between valid and invalid arguments;
5. think critically and assess arguments in texts, conversations and day-to-day discussions;
6. critically asses the rationality or otherwise of human conduct under different existential conditions;
7. develop the capacity to extrapolate and deploy expertise in logic to other areas of knowledge; and
8. guide his or her actions, using the knowledge and expertise acquired in philosophy and logic.

Course Contents

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

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

Learning Outcomes

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

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

Course Contents

Concept of entrepreneurship (entrepreneurship, 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.

BCH 201: General Biochemistry I (2 Units C: LH 30)

Learning Outcomes

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

1. explain the structure of different macromolecules in biological system;
2. identify types of chemical reactions involving these macromolecules;
3. explain the various methods of isolation of these macromolecules;
4. estimate the effects of acids and alkalis on the macromolecules;
5. describe purification of macromolecules; and
6. discuss quantification of the various macromolecules.

Course Contents

Introductory chemistry of amino acids, their properties, reactions and biological functions. Classification of amino acids: neutral, basic and acidic; polar and non-polar; essential and nonessential amino acids. Peptides. Introductory chemistry and classification of proteins. Biological functions of proteins. Methods of their isolation, purification and identification. Primary, secondary, tertiary and quaternary structures of proteins. Basic principles of tests for proteins and amino acids. Introductory chemistry of carbohydrates, lipids and nucleic acids. Nomenclature of nucleosides and nucleotides, effects of acid and alkali on hydrolysis of nucleic acids.

BCH 202: General Biochemistry II (2 Units C: LH 30)

Learning Outcomes

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

1. explain the structure of the cell including its components;
2. discuss the interrelationship between different organelles of the cell;
3. recognize the differences between plant and animal cells;
4. isolate the various organelles of both plant and animal cells; and
5. describe the influence of hydrogen ion concentration on cellular function.

Course Contents

The cell theory. Structures and functions of major cell components. Cell types, constancy and diversity. Cell organelles of prokaryotes and eukaryotes. Chemical composition of cells.
Centrifugation and methods of cell fractionation. Structure, function and fractionation of extracellular organelles. Water, total body water and its distribution. Regulation of water and electrolyte balance. Disorder of water and electrolyte balance. Acidity and alkalinity, pH and pK values and their effects on cellular activities.

BCH 203: General Biochemistry Practical (1 Unit C: PH 45)

Learning Outcomes

At the end of the course, students will be able to understand the various laboratory procedures used in the study of various biochemical processes described in BCH 201 and 202.

Course Contents

Laboratory experiments designed to reflect the topics covered in BCH 201 and BCH 202. Introduction to laboratory methods and procedures employed in studying biochemical processes.

STA 201: Statistics for Agriculture and Biological Sciences (3 Units C: LH 45)

Learning Outcomes

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

1. explain the scope for statistical methods in biology and agriculture;
2. define the measures of location, partition and dispersion;
3. explain the elements of probability; probability distributions: binomial, poisson, geometric, hypergeometric, negative binomial and normal, Student's t and chi-square distributions;
4. differentiate point from interval estimation and could be able to tests for hypotheses concerning population means, proportions and variances;
5. compute for regression and correlation as well as conduct some Non–parametric tests with reference to Contingency table analysis; and
6. explain the elements of design of experiments and Analysis of variance.

Course Contents

Scope for statistical method in Biology and Agriculture. Measures of location, partition and dispersion. Elements of probability. Probability distributions: binomial, Poisson, geometric, hyper geometric, negative binomial and normal, Student's t and chi-square distributions. Estimation (point and interval) and tests of

hypotheses concerning population means, proportions and variances. Regression and correlation. Non–parametric tests. Contingency table analysis. Introduction to design of experiments. Analysis of variance.

GOU-BCH 204: Process Biochemistry (2 Units; Compulsory; LH = 30; PH = 0)

Senate-Approved Relevance

This course is designed to expose biochemistry students to the basic concepts of anaerobic metabolism and the biochemical principles and processes involved in the use of enzymes of microorganisms for the manufacture of useful products such as biofuels, food and alcoholic beverages. With the drastic increase in world's population growth, energy consumption has increased unprecedentedly. The exploitation of fossil fuels has led to depletion of such resources. There is therefore the need for development of renewable energy sources. The abundance of biomass and its immense potential as a renewable source of energy, food and alcoholic beverages makes it a suitable alternative to be used for energy production. In addition, biomass- derived materials can be used for food and alcoholic beverages production. The training of biochemistry students in the field of bioenergy production is in line with Godfrey Okoye University's mission to equip students for the labor market. It also aligns with the sustainable development goal on energy (SDG 7) "Call for affordable, reliable, sustainable and modern energy services for all" by 2030.

Overview

The goal of this course is to expose graduates of biochemistry to the principles and processes involved in the use of biomass for different purposes such as biofuels and food production. The over-dependence on fossil fuels has led to shortage in fossil reserves and increase in wastes which are not environmentally compatible.

Therefore, there is need for alternative and renewable energy source. This course is designed to address this challenge. The course objectives, learning outcomes and course contents are provided to address this need.

Objectives

The objectives of the course are to:

1. Explain the isolation, culture, and identification of different anaerobes.
2. Describe the biochemical processes of anaerobic digestion and fermentation.
3. Enumerate the major sources of biomass.
4. Explain the principles and applications of biomass in biofuels, food and alcoholic beverages production.
5. Illustrate production of single cell protein.

Learning Outcomes

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

1. Enumerate three sources of biomass.
2. Identify and explain at least five different microorganisms involved in the conversion of biomass into useful products.
3. Explain the basic concepts of anaerobic metabolism.
4. Explain three biochemical principles and methods involved in the conversion of biomass into useful products.
5. Describe at least three microbial technique for treatment of waste water and sewage.

6. Describe the procedure for production of single cell proteins.

Course Contents

Biomass: Definition and sources. Anaerobic metabolism. Isolation, cultivation and identification of anaerobes. Biotechnology processes and their life science aspects. Biochemical processes of anaerobic digestion and fermentation. Biochemical processes in microbial production of yoghurt, cheese, alcoholic beverages, pharmaceuticals and industrial chemicals. Application of biomass for biofuel generation. Microbial technique: treatment of waste water and sewage. Production of single-cell proteins. Biocatalysis. Application of Bioprocess and bioreactor to healthcare sectors. Mass transfer, mixing, scale-up and scale-down. Bioprocess monitoring. Bio-manufacturing. Bioseparation, purification, protein refolding. Enzyme engineering and biotransformation. Downstream processing. Modeling, optimization and control techniques.

Minimum Academic Standards

As found in 70% CCMAS

GOU-BCH 205: Soil Biochemistry (2 Units; Elective; LH = 30; PH = 0)

Senate-Approved Relevance

Soil Biochemistry refers to the characteristics and Dynamics of organic matter and the biochemical transformations brought about by enzymes and organisms in the soil. Food security is an important aspect of economic development. However, there are enormous challenges militating against food production in Nigeria. The training of biochemistry graduates who are knowledgeable in the field of Soil Biochemistry is in line with Godfrey Okoye University's mission to produce graduates who are ready for epistemic and cultural dialogue in all its ramifications. It also aligns with the sustainable development goal to "End hunger, achieve food security and improved nutrition through sustainable agriculture" (SDG 2).

Overview

The goal of this course is to provide students at undergraduate level with scientific foundations needed to understand and apply the basic biochemical principles and skills with regards to how soil properties can be managed for optimal agricultural production and food security. Soil degradation and decline are increasing at an alarming rate due to increasing population.

There is therefore need for improvement in soil quality and sustainable crop production for economic development in Nigeria. This course is designed to address this challenge. The course objectives, learning outcomes and course contents are provided to address this need.

Objectives

The objectives of the course are to:

1. Explain soil-related problems in biochemical terms.
2. Analyze the factors influencing soil fertility, structural stability and soil biology.
3. Describe the fundamental process of formation and decomposition of organic matter.
4. Explain the biochemical principles and processes such as carbon dioxide, nitrogen and metal transformations in the soil.
5. Explain the importance of soil quality in crop production.
6. Develop skills in critically evaluating scientific findings related to soil and environmental biochemistry and in preparing and presenting oral and written technical information.

Learning Outcomes

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

1. Explain the chemistry of soil organic matter.
2. Describe the biochemistry of soil microbial biomass.
3. Explain the biochemistry of CO_2 transformation in the soil.
4. Explain the biochemistry of nitrogen, sulphur and phosphorus in the soil.
5. Describe the biochemistry of biologically active materials in the soil.
6. Explain the biochemistry of metals in the soil.
7. Describe the biochemistry of xenobiotic in the soil.
8. Explain the fate of genetic materials in the soil.

Course Contents

Soil Biochemistry: Definition and Scope. Soil chemical processes. Soil Enzymes and Enzyme Kinetics. The Microbial Biomass and Soil Biochemistry. Biochemistry of Carbon Transformations in Soil. Biochemistry of Nitrogen Transformations in Soil. Biochemistry of Phosphorus and Sulfur Transformations in Soil. Biochemistry of Metal Transformations in Soil. Biochemistry of Xenobiotics in Soils. Biochemistry of Biologically Active Materials in Soil. Chemistry of soil organic matter. Genetic materials in the soil. Soil-related problems in biochemical terms. Factors influencing soil fertility, structural stability and soil biology. Fundamental process of formation and decomposition of organic matter. Importance of soil quality in crop production. Biodegradation of pollutants and pesticides.

Minimum Academic Standards
As found in 70% CCMAS

GOU-BCH 206: Tropical Medicinal Plants (2 Units; Compulsory; LH = 30; PH = 0)
Senate-Approved Relevance
This course is in line with Godfrey Okoye University's vision to establish a biodiversity garden in the main campus. The training of biochemistry students who are knowledgeable in this field will provide them with ample knowledge about various medicinal plants and its relevance in health and agriculture sector. The documentation of medicinal uses of Nigerian plants is becoming increasingly urgent because of the rapid loss of the natural habitat for some of these plants due to anthropogenic activities. Halting deforestation and restoring the use of terrestrial ecosystems is necessary to reduce the loss of natural habitats and biodiversity which are part of our common heritage (Life on Land: SDG 15)

Overview
Plants have been used as sources of remedies for the treatment of many diseases since ancient times and people of all continents especially Africa have this old tradition. Despite the remarkable progress in synthetic organic medicinal products of the twentieth century, over 25% of prescribed medicines in industrialized countries are derived directly or indirectly from plants.
During the past decade, traditional medicinal practices have become a topic of global relevance. In many developing nations, a significant number of indigenous populations rely on medicinal plants to meet their health care needs. Knowledge of this course will create employment for students in the health sector because botanically derived medicinal plants have played a major role in human societies throughout history and prehistory and people have used plants as medicine since the beginning of civilization, as they were believed to have healing powers.

Objectives
The objectives of the course are to:

1. Describe the locally available medicinal plants.
2. Explain history, nomenclature and types of medicinal plants.
3. Describe various scientific methods employed in the search for bioactive compounds in medicinal plants.
4. Enumerate Herbal medicine regulation.
5. Explain drug development from medicinal plants.

Learning Outcomes
At the end of the course, students should be able to:
Identify and explain at least twenty tropic medicinal plants, and associate them with habitats.

Identify plants with Herbarium and specimens.

Describe the life histories strategies of selected plants.

Explain ten economic importance of medicinal plants.

Describe mechanisms of action of natural products as medicine.

Discuss at least six opportunities, issues, and problem-solving techniques associated with medicinal plants in Nigeria.

Course Contents

Identification and collection of medicinal plants. Processing of medicinal plants. Medicinal plant extracts. Methods in medicinal plant research. Phytochemistry. Bioassay methods in natural product research. Conservation and biodiversity of medicinal plants. Overview of drug development from medicinal plants. Common medicinal plants and their uses. Bioactive compounds in medicinal plants. Mechanisms of action of natural products as medicine. Herbal business and herbal processing technology. Herbal medicine regulation and relevant agencies. Research trends on medicinal plants. Guidance for research on medicinal plants for local drug production. Economic importance of medicinal plants. Opportunities, issues, and problem-solving techniques associated with medicinal plants in Nigeria.

Minimum Academic Standards

As found in 70% CCMAS.

GOU-BCH 207: Microbial Biochemistry (2 Units; Compulsory; LH = 30; PH = 0)

Senate-Approved Relevance

Microbial Biochemistry is the study of metabolic processes that occur in microorganisms. The teaching of the course to Biochemistry students will enable them to apply the knowledge and expertise in industries as well as in waste treatment and pollution control thereby promoting SDG 11 – making cities and environment safe for human settlement. It is the mission of Godfrey Okoye University to produce graduates who are equipped to work with industries and who are able to solve societal problems through science.

Overview

The teaching of Microbial Biochemistry to students is critical to the understanding of the biology of microorganisms and their interactions with their environment. The scope of the

course covers the metabolism of microorganisms such as bacteria, fungi and viruses. It also includes the primary are secondary metabolites of various microorganisms and the application of microorganisms and their products in industries, waste treatment and pollution control.

The training of students in this field will equip them with the knowledge and expertise to address some of the challenges of our immediate environment such as environmental pollution.

Objectives

The objectives of the course are to:

1. Characterize and classify different microorganisms.
2. Explain the metabolism of microorganisms.
3. Describe Microbial genome.
4. Explain Microbial signal transduction and homeostasis.
5. Explain protein synthesis and regulation of gene expression.
6. Describe mutation and mutagenesis.
7. Explain the molecular basis of recombination, conjugation and transduction.
8. Explain the application of Microbial Biochemistry in industries.

Learning Outcomes

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

1. State the different classification of microorganisms.
2. Describe the major metabolic pathways of microorganisms.
3. Differentiate between Microbial signal transduction and homeostasis.
4. List at least four steps in Microbial protein synthesis.
5. State the molecular basis of conjugation and transduction.
6. Enumerate at least one application each, of Microbial Biochemistry in food industry, chemical industry, pharmaceutical industry and in mining industry.

Course Contents

Microbial systematics. Microbial structure. Microbial metabolism. Microbial growth. Physiology and metabolism. Microbial degradation. Microbial diversity. Antimicrobial agents. Nitrogen fixation. Microbial genome. Protein synthesis. Regulation of gene expression. Signal transduction. Homeostasis. Recombination. Conjugation. Transduction. Application of microbial Biochemistry in industries. Waste treatment. Pollution control and in treatment and control measures for infectious diseases. Control of microorganisms and sterility. Microbiological techniques. Microbial interactions with their environment.

Minimum Academic Standards

As found in 70% CCMAS.

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 and 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 Kartaf, chieftaincy and land disputes many more. Peace building, management of conflicts and Security, peace and human development. Approaches to peace &conflict management-(religious, government, community leaders and many more). Elements of peace studies and conflict resolution: conflict dynamics assessment scales, constructive and destructive. Justice and legal framework: concepts of social justice. The Nigeria legal system. Insurgency and terrorism. Peace mediation and peace keeping. Peace &security council (international, national and local levels). Agents of conflict resolution: conventions, treaties, community policing, evolution and imperatives. Alternative Dispute Resolution (ADR) : a). Dialogue b). Arbitration, c). Negotiation d). Collaboration and many more Roles of International Organisations 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 and market research). Entrepreneurial finance (venture capital, equity finance, micro finance, personal savings, small business investment organisations 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 bookkeeping, 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 and many more. Digital Business and ECommerce Strategies).

BCH 301: Enzymology **(2 Units C: LH 30)**

Learning Outcomes

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

1. discuss why enzymes are grouped into different classes;
2. explain the basis of classification of enzyme;
3. identify the role vitamins in the cellular system;
4. illustrate the basis and mechanism of enzyme- catalysed reactions; 5. derive equations governing enzyme reactions in cellular systems; and
6. explain the effect of various factors on enzyme reactions.

Course Contents

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

BCH 302: Metabolism of Carbohydrates **(2 Units C: LH 30)**

Learning Outcomes

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

1. explain the structure and functions of various polysaccharides;
2. describe the various pathways polysaccharides could be broken down in cellular systems;
3. discuss how the end product of carbohydrate metabolism is attained; 4. explain the central importance of TCA cycle in cellular metabolism; and
5. predict consequences of disorders of carbohydrate metabolism.

Course Contents

Chemistry and function, isolation and purification of polysaccharides. Molecular weight determination and analytical methods for structural determination of polysaccharides. Biochemistry of important disaccharides, oligosaccharides and polysaccharides; degradation and digestion of carbohydrates - sugars, storage polysaccharides and cell walls. Glycolysis, the tricarboxylic acid cycle, the phosphogluconate pathway, the glycoxylate pathway; the pentose phosphate pathway and the cori cycle, the calvin pathway. Gluconeogenesis and glycogenesis, glycogenolysis, metabolism of fructose, Polyol pathway. Regulation of carbohydrate metabolism. Disorders of carbohydrate metabolism.

BCH 303: Metabolism of Lipids **(2 Units C: LH 30)**

Learning Outcomes

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

1. describe how various types of lipids (fats and oil) are synthesized;
2. discuss the implication of unsaturation in lipids and oils;
3. explain the mechanism of their degradation;
4. describe the importance of the various pathways of lipid metabolism; and
5. explain the implication of disorder in metabolism to the cellular systems.

Course Contents

Classification of lipids - fatty acids, triglycerides, glycosylglycerols, phospholipids, waxes, prostaglandins. lipid micelles, monolayers and bilayers. Oxidation of fatty acids. Microsomal peroxidation of polyunsaturated fatty acids. Metabolism of unsaturated fatty acids: essential and non-essential. Metabolism of acylglycerols. Metabolism of phospholipids. Cholesterol biosynthesis and breakdown. Metabolism of ketone bodies. Integration of lipid metabolism. Acetic acid as a central precursor for biosynthesis of lipids. Lipoprotein metabolism and transport of lipids. Adipose tissue metabolism.

BCH 304: Metabolism of Amino Acids & Proteins (2 Units C: LH 30)

Learning Outcomes

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

1. illustrate why and how proteins are broken in cellular systems;
2. explain how to determine the molecular weight of proteins;
3. recognise the relationship between the urea cycle and other pathways of protein metabolism; 4. describe the differences between ketogenic and glucogenic amino acids; and
5. identify the role of inorganic nitrogen in protein synthesis and breakdown.

Course Contents

Amino acids as building blocks of proteins and the peptide bond as covalent backbone of proteins. Forces involved in the stabilization of protein structure. Protein isolation, fractionation, purification and characterization. Amino acid analysis of peptides and proteins. Methods for the determination of the sequence of amino acids in proteins. Protein biosynthesis, molecular weight determination of proteins. Techniques in protein biochemistry. Oxidative degradation of amino acids and metabolism of one carbon units. Ammonia toxicity and urea formation. Ketogenic and glucogenic amino acids. Biosynthesis of amino acids and some derivatives, the urea cycle; metabolism of inorganic nitrogen. Disorders of amino acid metabolism and polyamines.

BCH 305: Metabolism of Nucleic Acids (2 Units C: LH 30)

Learning Outcomes

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

1. explain the levels of organisation of nucleic acids;
2. discuss the three- dimensional structure of nucleic acids;
3. interpret how information encoded in genes are able to direct protein synthesis; 4. describe the structure of proteins from nucleic acid composition of the gene; and
5. identify the various implications of disorders in nucleic acid metabolism.

Course Contents

Structure and function of nucleic acids. The genetic code and protein synthesis. Metabolism of purines and pyrimidines, nucleosides and nucleotides. Degradation of purine and pyrimidine nucleotides. DNA replication and DNA repairs. Disorders and abnormalities of nucleic acid metabolism-gout, Lesch-Nyhan syndrome, hypouricaemia, orotic aciduria, Reye's syndrome, Xeroderma pigmentosus and skin cancer.

BCH 306: Analytical Methods in Biochemistry (3 Units C: LH 30; PH 45)

Learning Outcomes

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

1. explain the principles of instrumentation in biochemistry;
2. describe how the level of precision attained in analysis is dependent on the method employed;
3. discuss why a method is preferred in a particular biochemical investigation; 4. explain the theoretical basis of major instruments used in biochemical analyses; and
5. perform some specific analytical investigations.

Course Contents

Tissue and cell culture techniques, immunoassays, blotting and isotopic techniques. Principles, methodologies, instrumentation and applications of electrophoresis, manometry and centrifugation techniques. Chromatographic techniques including paper, thin layer, column, gas, and high-performance chromatographic techniques. Spectroscopic techniques including uvvisible, infra-red, nuclear magnetic resonance and mass spectrometry. Fluorimetry, polarographic including potentiometric and electrometric measurements. State-of-the-art equipment: gas chromatography-mass spectrometry, thermocycler, high performance liquid chromatography, nuclear magnetic resonance, fourier-transform infrared spectroscopy. This course includes laboratory practical classes, which will provide students the opportunity to practice the various techniques and familiarise themselves with the types of equipment used for the techniques.

BCH 307: Membrane Biochemistry (2 Units C: LH 30)

Learning Outcomes

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

1. explain the role of membrane as gatekeeper of cells;
2. describe the make-up of membranes;
3. identify the models used to explain the arrangement of molecules contained in membranes; and
4. discuss the mechanism of transportation of molecules into and out of cells.

Course Contents

Structure, composition and functions of biological membranes. Isolation, characterization and classification of membranes; chemistry and biosynthesis of membranes. Molecular organisation of membrane components. Natural and artificial membrane bilayers - the unit membrane hypothesis and fluid mosaic model. Membrane transport system - active versus passive transport systems. Transport of sugars and amino acids.

BCH 308: Bioenergetics (1 Unit C: LH 15)

Learning Outcomes

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

1. illustrate how biological energy is generated in the cells;
2. explain the concept of 'fuel molecules'; and
3. imbibe comprehensive knowledge of biological energy transformation and utilisation.

Course Contents

High-energy compounds. Chemical thermodynamics, Oxidations and reductions. Chemical potentials, Electrochemical potentials, Electron transport system and oxidative phosphorylation. Uncouplers of oxidative phosphorylation. Shuttle systems for oxidation of extra-mitochondrial NADH, ATP Cycle, Regulation of ATP production.

BCH 309: Inorganic Biochemistry (1 Unit C: LH 15)

Learning Outcomes

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

1. explain the roles of inorganic ions in biological systems;
2. discuss the functions of ions in enzyme actions; and
3. describe the importance of nitrogen and sulphur cycles in living systems.

Course Contents

Relationship between the physicochemical properties and biological functions of inorganic ions. Ligand complexes and their biochemical significance. Trace elements in biological systems.
Electrolyte metabolism. Nitrogen cycle and sulphur cycle.

BCH 399: Industrial Attachment (For 4 year Programme - 12 weeks) (3 Units C: PH 135)

Learning Outcomes

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

1. explain how theoretical principles in biochemistry are employed in industrial production; and
2. describe the clinical application of various metabolic abnormalities for those in clinical laboratories.

Course Contents

Students should be attached to some relevant industrial organisations for 12 Weeks at the end of 300 Level during the long vacation before commencement of 400 Level. Assessment to be based on seminar presentation, report and assessment by their industry and university supervisors.

GOU-BCH 310: Molecular Basis of Infectious Diseases (2 Units; Compulsory; LH= 30; PH = 0)

Senate-Approved Relevance

The incidence of infectious diseases has continued to have major health and economic costs in Nigeria. The teaching of molecular basis of infectious diseases will give biochemistry graduates opportunity to acquire knowledge and skills which will go a long way in making them to be well-suited to a variety of roles in public health. Such roles include providing information about infectious agents and preventive measures. This course is intended to for the purpose of producing graduates who are able to solve societal problems, a goal to which Godfrey Okoye University commits itself. The course also shares same purpose as the sustainable development goal to "Ensure healthy lives and promote well-being for all, at all ages" (SDG 3).

Overview

Infectious diseases such as malaria and AIDS are among the most common diseases worldwide and they are an important cause of morbidity and mortality in developing countries. Infectious diseases of all types remain among the greatest threats to human health. Combating these imminent threats requires a detailed understanding of biological processes that are the basis for infection and diseases.

The course is aimed at equipping students with knowledge in current methods for studying the transmission, diagnosis, pathogens and therapeutics of infectious diseases that are of public concern in Nigeria and other Sub-Saharan African countries.

Objectives

The objectives of the course are to:

Classify and explain infectious diseases.

Enumerate the safety measures taken when working with pathogens.

Explain the strategies for management of infectious diseases.

Describe the molecular basis of host specificity, infection, pathogenicity, diagnostics, therapeutics and vaccines for infectious diseases caused by various pathogens.

Describe safety measures when working with pathogens.

Learning Outcomes

On completion of this course, the student should be able to:

List and explain four classes of infectious diseases.

Enumerate at least four safety measures taken when working with pathogens.

Explain at least three strategies for management of infectious diseases.

Describe the molecular basis of host specificity, infection, pathogenicity and vaccines for at least two infectious diseases caused by bacteria.

Describe the molecular basis of host specificity, infection, pathogenicity, diagnostics, therapeutics and vaccines for at least two infectious diseases caused by viruses.

Describe the molecular basis of host specificity, infection, pathogenicity, diagnostics and therapeutics for at least two infectious diseases caused by parasites.

Describe the molecular basis of host specificity, infections, pathogenicity, diagnostics and therapeutics for at least two infectious diseases caused by fungi.

Course Contents

Classification of infectious diseases. Patterns of diseases. Measuring infectious disease frequency. Emerging and re-emerging infectious diseases and pathogens. Source- reservoir and transmission of pathogens. Safety measures when working with pathogens. Biosafety levels, infections and evasion. Roles of drugs. Vaccines. Hygiene and sanitation in prevention. Transmission. Control and treatment of infectious diseases. Classification of bacterial pathogens. Overview of bacterial virulence factors and host- pathogens interactions. History, causative agents. Molecular basis of host specificity. Infection and pathogenicity. Diagnostics. Therapeutics and vaccines. Drug resistance and implications on public health; host pathogens interactions. Symptoms, diagnosis. Vaccines and drugs against tuberculosis. Typhoid. Diphtheria. Pertusis. Tetanus. Baotulinum. Cholera. Authrax and Puenumonia. Mechanisms of action and drug resistance for various antimicrobial agents. Structure of viruses. Classification. Overview of viral virulence factors and host pathogen interactions. History of AIDS. Causative agent. Ppathogenesis. Diagnostics. Drugs. Other viral diseases. Hepatitis influenza. Rabies. Dengue and polio. Chicken pox. Herpes virus. Biochemical basis of mechanism of action and drug resistance of various antimicrobial agents.

History of malaria. Causative agents. Vectors. Life cycle. Host parasite. Interactions. Diagnostics. Drugs. Vaccine development. Other diseases including leishmaniasis. Amoebiasis and Trypanosoma infections. Biochemical basis of mechanism of action and drug resistance for various antimicrobial agents. Fungal diseases such as candidiasis. Sporotrichosis, Aspergillosis and ring worm. General disease characteristics. Medical importance. Pathogensis, diagnosis and treatment. Biochemical basis of mechanism of action and drug resistance for various antimicrobial agents.

Minimum Academic Standards

As found in 70% CCMAS.

GOU-BCH 311: Computational Biochemistry (2 Units; Compulsory; LH = 15; PH= 45)

Senate-Approved Relevance

The goal of this course is to produce a new generation of Biochemists with knowledge and skills in computer and information science which can be used to solve biochemical problems and develop new biotechnologies. The training of undergraduate students in this field will enable them to acquire important information and online resources which include biomedical library, protein and DNA sequence databank and interactive metabolic pathway tools. Information and communication technology – are crucial to achieving sustainable development and empowering communities in many countries. (SDG 9). Relevance is seen in Biochemistry graduates from Godfrey Okoye University being able to acquire skills and expertise in Computational biochemistry that can be applied in agriculture, medicine and production of new drug candidates.

Overview

Computational Biochemistry is currently attracting serious attention from the scientific and industrial community. Advances in genome techniques have led to an explosive growth in the biological data generated by the scientific community. The critical need to process and analyze data and turn it into useful knowledge has caused Computational Biochemistry to gain prominence and importance. There is, therefore, the need for biochemistry undergraduates to acquire adequate knowledge and skills in Computational Biochemistry.

This course is designed to address this challenge by equipping students with knowledge and skills in Computational biochemistry and how this knowledge can be used to develop new biotechnologies. The importance of the course lies in meeting the need in achieving sustainable development goal number 4 (SDG 4) which requires putting in place an agenda for information and communication technology. The objectives of the course, learning outcomes and course contents are provided to address this need.

Objectives

The objectives of the course are to:

1. Explain the concepts and terminology of computational biochemistry.
2. Apply molecular modelling and molecular mechanics to predict biochemical phenomena such as chemical structure, bonding and reactivity.
3. Describe the use of molecular graphics software and operating systems.
4. State and explain the principles and applications of computer technology in biochemistry.
5. Explain mechanisms of biomolecular interactions.
6. Explain mechanisms of protein-carbohydrate and protein-nucleic acid interactions.

Learning Outcomes

On completion of this course, the student should be able to:

1. Relate theory, concepts and terminology of computational biochemistry with emphasis on organizations of biochemical components.
2. Illustrate the major biotransformation reactions and applications of computer technology in biochemistry.
3. Identify and explain at least three basic mechanisms of biomolecular interaction, as well as protein-protein interactions.
4. Perform skillfully and analytically thinking molecular docking, computer simulations and conformational analysis.
5. Compile the patterns and mechanisms in genome evolution with evolutionary dynamics.

Course Contents

Organization of biochemical components – structural, dynamics and information biochemistry. Introduction to molecular dynamics. Major biotransformation reactions in biological systems. Application of physical principles in computing. Application of computer technology in biochemistry. Computational aspects – mechanisms of biomolecular interactions. Mechanisms of protein-carbohydrate and protein-nucleic acid interactions. Deriving biological functions of genome information with sequence and structure analysis. Prediction of protein functions. Computer simulations. Conformational analysis. Clues from three-dimensional structure analysis. Molecular docking patterns of mechanisms in genome evolution. Evolutionary dynamics. Statistical Analysis of Biochemical Data. Biochemical Data Analysis with Spreadsheet Application. Biochemical Data Management with Database Program.

Minimum Academic Standards

As found in 70% CCMAS.

GOU-BCH 312: Tropical Plants-based Drugs for Disease Management (2 Units; Compulsory; LH = 30; PH = 0)

Senate-Approved Relevance

Herbal medicines encompass the combination of practices of indigenous systems of medicine and several therapeutic experiences of many previous generations. The incidence of disease and its management has continued to have major health and economic costs in Nigeria. The teaching of plant-based drugs for diseases management will give Godfrey Okoye biochemistry graduates opportunity to acquire knowledge and skills which will go a long way in making them to be well-suited to a variety of roles in public health.

Overview

Plants have been used as the source of drugs for long ages, and as of today, approximately 70,000 species have been screened for their potential utility as medicines. At present, about eight out of ten drugs used to treat infection, cardiovascular disease, or cancers, or as immunosuppressives, come from tropical plants, directly or as derivatives. Between 1981 and 2006, approval was granted to 155 antitumor drugs, of which almost half were derived from natural products.

The high degree of uncertainty of commercial drugs has led to a focus on plant-based chemicals for drug discovery, especially since these are seen as safe and more effective than synthetic chemicals. Knowledge of this course will position our students in public health sector.

Objectives

The objectives of the course are to:

1. Identify and explain the tropical plants-based risk factors associated with development or progression of major chronic diseases, such as cardiovascular diseases, cancer and diabetes.
2. Describe evidence for specific protective mechanisms and health benefits that may be provided at cellular, individual and global levels via plant-based drugs.
3. Discuss how nutritional advisement emphasizing plant-based approaches may be integrated into clinical practice, thus facilitating positive, measurable and cost effective clinical outcomes for various preventable chronic diseases.
4. Identify and explain the factors that influence dietary choices or discourage behavior change, as well as strategies and techniques for promoting sustainable nutritional advancement in individuals and communities.

Learning Outcomes

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

1. Describe herbal drug on management options on common diseases.
2. Identify and explain common tropical ailments using the traditional herbal approach.
3. Illustrate different mechanisms of action of tropical plant drugs.
4. Identify and explain the scientific research on medicinal plants in collaboration with traditional health practitioners to validate claims made on safety, efficacy and quality of traditional medicinal plants.
5. Describe at least four processes in development of drug from medicinal plant.

Course Contents

Herbal therapy. Anticancer. Antimalarials. Laxatives (including the role of vegetables and fruits). Anti-infectives (e.g. against measles, bacterial, fungal, etc). Anti-tussives. Anti-diarrhea. Antispasmodics. Anti-haemorrhoid. Analgesics. Antihelminthics. Antischistosomiasis. Anticonvulsants. Antipyretics. Anti-inflammatory. Antihypertensives.

Antisickling. Examples of plant drugs in current use in the existing conventional Pharmacopoeia. Ergometrine. Atropine. Quinine. Modern drug discovery from plants. Development process of a drug derived from herbal plants.

Minimum Academic Standards
As found in 70% CCMAS.

GOU-BCH 313: Immunology and Immunochemistry (2 Units; Elective; LH =30; PH = 0)

Senate-Approved Relevance
The subject of immunology belongs to the biological and medical sciences. The student will gain necessary intellectual tools to understand and appreciate the complexities of the immune system at the molecular level. The training of undergraduate students in this field will expose them to the principles and theories of self and non-self-defense systems of higher organisms promoting SDG 3 – good health and wellbeing. The teaching of Immunology and Immunochemistry will give Godfrey Okoye biochemistry graduates opportunity to acquire knowledge and skills which will go a long way in making them to be well-suited to a variety of roles in public health.

Overview
The highly complex nature of the immune system makes it difficult to view it as a whole, but researchers are now trying to put all the pieces of the puzzle together to obtain a more complete picture. The development of new specialized equipment and immunological techniques, genetic approaches, animal models, and a long list of monoclonal antibodies, among many other factors, are improving our knowledge of this sophisticated system.
Immunology is one of the most rapidly emerging branches of biological and medical science, which involve the study of immune system. The system of immunity is designed to defend the body from invading organisms through various defensive barriers. Immunochemistry involves the study of the functions of immune system on the basis of molecular mechanisms underlying the antigen–antibody specificity and their interaction. Knowledge of this course can be applied for the diagnosis and prognosis of diseases such as cancer, neurodegenerative disorders, brain trauma, microbial infections, and muscle diseases through developing locus-specific monoclonal antibodies.

Objectives
The objectives of the course are to:

1. Explain the genetic and biochemical basis of antigen specificity.
2. Explain tolerance and memory in adaptive immune responses.
3. Describe how innate immune responses relate to adaptive immune responses.
4. Explain the role of immune system components in medical applications.
5. Illustrate modes of action of antimicrobials.
6. Describe basic principles of Chemothorapy.

Learning Outcomes

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

1. State the relationship between immunology and other areas of science.
2. Discuss immunological processes at a cellular and molecular level.
3. Define central immunological principles and concepts.
4. Outline, compare and contrast at least three key mechanisms and cellular players of innate and adaptive immunity and how they relate.
5. Elucidate the genetic basis for immunological diversity and the generation of adaptive immune responses.
6. Outline three key events and cellular players in antigen presentation, and how the nature of the antigen will shape resulting effector responses.

Course Contents

Basic concepts of immunology. Overview of the immune system. Structure of antigenic determinants cellular response. Genetics of response to antigenic stimulation. Structure and classification of immunolglobulins and antibodies. Mechanisms of antibody formation. Antigen-antibody interactions. Role of lymphoid tissues and thymus in immuno-responses. Hypersensitivity, immunopathology, auto-pathology, auto immunology, tumor and transplantation immunology. Immunoprophylaxis modern techniques in immunology and immunochemistry. Principles of Chemothorapy. History of chemotherapy. Basic pharmacodynamics and pharmacokinetics. Chemotherapeutic agents: antibacterial, antifungal, antiviral antiprotozoan and anti helminths. Modes of action of antimicrobials. Chemotherapy of specific diseases. Drug bio-assays and sensitivity tests.

Minimum Academic Standards

As found in 70% CCMAS.

400 Level

BCH 401: Advanced Enzymology **(2 Units C: LH 30)**

Learning Outcomes

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

1. explain the concept and necessity for multi- enzyme actions;

2. describe the chemistry of catalysis;
3. discuss the role of active sites in enzymatic reactions;
4. illustrate various methods that could be used for enzyme assays; and
5. relate the mechanism of regulation of enzyme action and its synthesis.

Course Contents

Chemistry of enzyme catalysis. Steady state enzyme kinetics. Transient kinetic methods. Ligand binding and its application to enzymology. Kinetics of multiple binding sites. Mechanisms of two substrate systems. Molecular models of allosterism. Enzyme models of allosterism. Multi-enzyme complexes. Enzyme assays and techniques in enzymology. Criteria for determining purity of enzymes. Enzyme reconstitution. Regulation of enzyme activity and synthesis.

BCH 402: Molecular Biochemistry (2 Units C: LH 30)

Learning Outcomes

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

1. explain how genes can be sequenced to determine the structure of DNA contained therein;
2. illustrate the mechanism of replication of DNA in both procaryotic and eucaryotic organisms;
3. describe how genes can be influenced to obtain a pre-determined outcome; 4. discuss the mechanism of action of gene- specific chemical compounds; and 5. explain the bias of human genome project.

Course Contents

Gene structure and function. Nucleic acid function and biological function. DNA sequencing and restriction endonucleases. DNA repair mechanisms. Nucleic acid replication. Regulation of nucleic acid synthesis. Genetic code and gene-protein relationship. Eukaryotic transcription. Control of gene expression. Functional analysis of the replicator structure of bacteriophage DNA. Drugnucleic acid interactions. Initiation factor for viral DNA replication. Genetic control of viral replication. Model systems used for studying embryology at the molecular level. Model systems in differentiation studies. Cell cycle, Control of cell proliferation. Genetic engineering and recombinant DNA Technology. Polymerase chain reaction, human genome project and gene therapy.

BCH 403: Metabolic Regulations (2 Units C: LH 30)

Learning Outcomes

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

1. explain the central role of Kreb's cycle in macromolecular metabolism;
2. identify the inter-relationship between metabolic pathways of macromolecules;
3. describe how a product of one cycle can inhibit another pathway; and
4. identify the need to regulate various metabolic pathways and how the cell does it.

Course Contents

The relationship of Krebs' Cycle to protein, carbohydrate, lipid and nucleic acid metabolism. Integration of metabolic pathways. Turn-over rates and metabolic pools. Regulation of enzymes of metabolic pathways-feedback inhibition versus enzyme synthesis. Catabolite repression, end product repression. Identification of different regulatory mechanisms in metabolic pathways.

BCH 404: Biochemical Reasoning (1 Unit: C LH 15)

Learning Outcomes

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

1. apply their broad knowledge of biochemistry to explain any problem they confront; and
2. write scientific papers for conferences and publication.

Course Contents

Evaluation and design of experimental biochemistry from available information and data. Analysis, interpretation and inference: drawing from biochemical research data.

BCH 405: Plant Biochemistry (2 Units C: LH 30)

Learning Outcomes

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

1. describe the metabolic pathways that are peculiar to plants;
2. explain the concept of secondary metabolites and their application for medicinal purposes; 3. discuss the chemical processes involved in photosynthesis as basis of life; and
4. identify the importance of hormones of plant origin.

Course Contents

Organisation of plant cells. The plant cell wall structure, formation and growth. Biochemistry of plant development. Lignin formation. The biochemistry of important plant processes and metabolic pathways. Photosynthesis. Secondary metabolites. Plant hormones and structureactivity relationship of plant hormones. Biosynthesis of carotenoid pigments. Synthetic growth regulators and herbicides. Indigenous plants of medicinal importance. Recent advances in medicinal plant biochemistry.

BCH 406 Research Projects (6 Units C: PH 270)

Learning Outcomes

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

1. explain laboratory procedures including safety precautions;
2. carry out independent researches that will lead to tangible outcomes; and
3. present outcome of their researches in seminars and conferences.

Course Contents

Independent research findings into selected areas/topics of interest to the supervising academic staff. Students will be required to carry out literature survey on the topics, perform experiments and produce reports (preferably at the end of second semester). Students will be subjected to both seminar and oral examination on the projects undertaken.

BCH 407: Bioinformatics (2 Units C: LH 30)

Learning Outcomes

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

1. identify the use of computational methods to predict life processes; and
2. explain various programmes applicable to life sciences.

Course Contents

An overview of bioinformatics, history of bioinformatics, genome sequencing projects, database searching algorithms (BLAST, FAST A), pair wise and multiple sequence alignments, phylogenetic analysis, data mining in novel genomes, current topics in bioinformatics and use of perl to facilitate biological analysis.

BCH 408: Biochemical Entrepreneurship (2 Units C: LH 30)

Learning Outcomes

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

1. explain how to apply their theoretical knowledge to start small/ medium scale production
   facilities;

2. describe the application of enzymes in industrial processes; and 3. discuss the importance of value chain in biochemical processes.

Course Contents

Entrepreneurship skills related to biochemistry, creation of new ventures/business, writing and designing business plans, feasibility studies, financial planning and management, production of local diagnostic kits, soap/detergents, crude commercial enzymes, quality vegetable oils, bread, confectionery, food processing/packaging and preservation, production of ointments and medicinal plant extracts. Students will be grouped in areas of interest.

GOU-BCH 409: Biochemical Application in Forensic Science (2 Units; Compulsory; LH = 30; PH = 0)

Senate-Approved Relevance

Forensic science is the application of natural and physical science to matters of criminal and civil law. The training of biochemistry graduates who are knowledgeable in the field of forensic science will acquaint them with techniques of crime scene investigation. This is in line with the mission Godfrey Okoye University, which is to foster entrepreneurial ecosystem in the university that would facilitate unity along with the development of talents, skills, knowledge and confidence.

Overview

This course is designed to expose students to the latest scientific investigation procedures and the basic scientific principles underlying the applied methods in forensic analysis of evidence and samples for clues to solve crimes. The constitution of Nigeria through its various articles strives to ensure security and safety of its citizens in accordance with the principles of universal declaration of human rights.

However, crime is a violation of these principles. The crime rate is increasing exponentially in the country especially in metropolitan cities such as Enugu. If we have to create a condition conducive to harmonious development, we must mitigate the crime rate. This course is designed to effectively address this challenge. The objectives of the course, learning outcomes and the course contents are provided to address this need.

Objectives

The objectives of the course are to:

1. State and explain the fundamental concepts and principles of forensic science and their significance.
2. Explain the importance of health and safety protocols in sample collection and analysis.
3. Discuss the theory and application of the basic biochemical processes such as body fluid identification in forensic context.

4. Identity and explain individuals by fingerprints, footprint, DNA analysis etc.
5. Describe the basic scientific principles and techniques underlying various applied methods used in analyzing biological evidences.
6. Describe basic scientific principles and techniques used in analyzing chemical evidence.
7. Explain the principles and technique of DNA profiling technology employed in crime laboratories.
8. Identify and explain the challenges and explore the limitations involved in deploying biochemical techniques in forensic science.

Learning Outcomes

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

1. State and explain at least five principles of forensic science and their significance.
2. Describe the application of body fluid identification in forensic context.
3. Describe three methods to establish the identity of an individual.
4. Describe at least three basic scientific techniques underlining various applied methods used in analyzing biological evidences.
5. Describe basic scientific techniques used in analyzing chemical evidences.
6. Explain the DNA profiling technology employed in crime laboratories.

Course Contents

Principles of forensic science. History and development of forensic sciences. Defining the scene of investigation. Collection, packaging, labelling and forwarding of biological exhibit to forensic laboratory. Biological evidence. Health and safety protocols in sample collection and analysis. Biochemical analysis of various biological evidences like blood, semen and other biological fluids. Establishment of identity of individuals - fingerprints, blood and DNA. Forensic entomology. Biochemical basis for the determination of cause of death. Narcotic analysis. Theory and forensic significance. Qualitative analysis of evidence using spot testing and microscopy. Polygraph. Challenges and limitations of the biochemical techniques. Obtaining and interpreting toxicology reports. Study of body fluids. Origin of specific materials or substances.

Minimum Academic Standards

As found in 70% CCMAS.

GOU-BCH 410: Molecular Docking (2 Units; Compulsory; LH=15; PH=45)

Senate-Approved Relevance

The field of molecular docking is a rapidly growing area of molecular modelling and drug discovery, and this course is designed to provide students of Godfrey Okoye University with a comprehensive understanding of the principles and practices of molecular docking. This course is suitable for currently enrolled students interested in advanced tools used in research, science enthusiast interested in drug designing and drug discovery.

Overview

Molecular docking may be seen as a problem of *"lock-and-key"*, in which one wants to find the correct relative orientation of the *"key"* which will open up the *"lock"*. In drug design, knowledge of the preferred orientation in turn may be used to predict the strength of association or binding affinity between two molecules.

Molecular docking is one of the most frequently used methods in structure-based drug design, due to its ability to predict the binding-conformation of small molecule ligands to the appropriate target binding site. Characterization of the binding behaviour plays an important role in rational design of drugs as well as to elucidate fundamental biochemical processes. Docking is most commonly used in the field of drug design. Several software were developed during the last decades, amongst which are some well-known examples, such as AutoDock, AutoDockVina, DockThor, GOLD, FlexX and Molegro Virtual Docker.

Objectives

The objectives of the course are to:

1. Discuss extensively a portion of the drug discovery pipeline.
2. Explain coding formats and organizational structure of chemical databases, interactions with such databases.
3. Identify potential lead molecules for drug development.
4. Explain the structure of biomolecules and more importantly link the structure and dynamics together.
5. Describe structure and dynamics in a quantitative way which enables rational drug discovery.

Learning Outcomes

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

1. Creatively apply and critically discuss three principles underlying prediction of protein/ ligand interactions using molecular docking and other techniques.
2. Critically evaluate and synthesis information about the key stages in the structure-aided drug discovery process.

3. Creatively apply and critically discuss the principles on which chemical databases are built, mechanisms for interacting with such databases, and approaches used when carrying out pharmacophore searches.
4. Use computers creatively to generate a virtual compound library in a database and query it for molecules with desired qualities.
5. Formulate at least four rules for selection of protein ligands and design and implement a screening protocol to select candidate ligands from a library of chemical compounds, based on their likelihood of docking to a proposed target.

Course Contents
Introduction of Molecular Docking. Conventional to Modern Drug Design. Molecular Docking Technique. Types of docking. Modes of Docking. Sampling Algorithms. Pose Selection. Docking Target. Target Preparation. Retrieving Ligand Molecules. Autodock. Preparing the Protein. Molecular docking for identification of potential targets for drug design. The use of machine learning algorithms in molecular docking. Application of molecular docking for the degradation of organic pollutants in the environmental remediation. Molecular modeling and ligand docking for solute carrier (SLC) transporters. Improvements, trends, and new ideas in molecular docking.

Minimum Academic Standards
As found in 70% CCMAS.

GOU-BCH 411: Cellular and Molecular Neuroscience (2 Units; Compulsory; LH = 30; PH = 0)

Senate-Approved Relevance

Cellular and Molecular Neuroscience publishes original research concerned with the analysis of neuronal and brain function at the cellular and subcellular levels. The course content reflects the highly diverse and interdisciplinary nature of Neuroscience. The student will gain necessary intellectual tools to understand and appreciate the complexities of the nervous system at the molecular and cellular level and also develop hypotheses and critically analyze methods and results in Neuroscience. This is in line with the mission of Godfrey Okoye University to ensure that graduates of the university are ready to pursue religious, cultural and epistemic dialogue in all its ramifications. The knowledge of this course will promote good health and well-being (SDG 3).

Overview
This course is designed to address and give new insights on the mysteries of the brain. By employing a cross-disciplinary, multi-level approach to study the nervous system, training of

biochemistry students on this course will break new ground in the search for how the brain forms and functions, and how neurological and psychiatric diseases affect basic biochemical processes. Innovative neuroscience study will expose Godfrey Okoye's student to these areas, linking molecular and cellular fields with neuroengineering, systems neuroscience, neurodevelopment and neurochemistry.

Neuroscience is a complex discipline integrating concepts of chemistry, physics, biochemistry, cell biology, pharmacology, physiology, anatomy, and psychology. The goal of this course is to provide both undergraduate and graduate students a comprehensive foundation of the cellular and molecular concepts governing the function and communication of the developing and adult nervous system ultimately forming complex behaviors such as learning and memory.

Objectives

The objectives of the course are:

1. Describe the foundation of the cellular and molecular concepts governing neuronal communication.
2. Explain cellular and molecular concepts integrate into complex behaviors.
3. State and explain the parallels between development and plasticity of neuronal interconnectivity.
4. Evaluate scientific research articles in cellular, molecular, and developmental neuroscience.
5. Describe neuromuscular junction and central synapses.

Learning Outcomes

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

1. Describe membrane potential and excitability
2. Explain neuronal action potentials
3. Explain synaptic transmission
4. State at least three structure/function aspects of voltage and ligand-gated ion channels
5. Explain G-protein signaling
6. Explain early brain development (gastrulation, neurulation)
7. Describe cellular adhesion and neuronal process outgrowth
8. Identify five basic techniques and experimental approaches in cellular and molecular neuroscience.

Course Contents

Membrane excitability. Ion channel function. G-protein signaling. Synaptic transmission. Development of the nervous system and innervation patterns. Cellular/molecular basis of learning and memory. Pharmacological approaches for the treatment of neuronal pathologies. The neuron. Origin and function of neuronal multiplicity. Subcellular organization of the neuron. Neuronal cytoskeleton. Molecular motors and axonal transport. Dendritic spines. Transport and targeting of dendritic mRNA. Local synthesis of proteins. Trafficking of axonal and dendritic proteins. Neurogenetics of Intellectual Disability disorders**.** Cellular communication in the nervous system. Neuron as secretory cell. The postsynaptic density. Neuromuscular junction versus central synapses. General classification of neurotransmitter receptors. Structure and function of GABA and glutamate receptors. Molecular composition and dynamic regulation of gabaergic and glutamatergic synapses. The endocannabinoid system. Adhesion molecules. Synaptic maintenance and synaptic plasticity. Non-synaptic

communication. Targeting neurons for Optogenetics. The Zebrafish model in Neurobiology. Glial cells. Morphology and classical roles. Astrocytes. Morphological & functional features. Reactive gliosis. Gliotransmission. Myelinating cells. Precursor cells. Myelination regulation and pathological aspects. Microglia. Physiological and pathological roles.

Minimum Academic Standards

As found in 70% CCMAS.

GOU-BCH 412: Nutrigenomics and Nutrigetenics (2 Units; Compulsory; LH = 30, PH = 0)

Senate-Approved Relevance

The goal of this course is to produce a new generation of Biochemists with knowledge on the current developments in nutrition and the interaction with genetics, the scientific evidence behind and the latest nutrigenomics studies and research. The training of undergraduate students in this field will enable them to acquire important information and online resources which include making use of the results of a genetic test with a focus on optimizing nutrition. Relevance is seen in Biochemistry graduates from Godfrey Okoye University being able to acquire skills and expertise in Nutrigenomics and Nutrigenetics that can be applied in medicine, nutrition and dietetics. This course is line with SDG 2 which is to end hunger, achieve food security and improved nutrition.

Overview

The recognition that nutrients have the ability to interact and modulate molecular mechanisms underlying an organism's physiological functions has prompted a revolution in the field of nutrition. The creation of nutrigenomics and nutrigenetics, two fields with distinct approaches to elucidate the interaction between diet and genes but with a common ultimate goal to optimize health through the personalization of diet, provide powerful approaches to unravel the complex relationship between nutritional molecules, genetic polymorphisms (variations), and the biological system as a whole.

Nutrigenomics aims to determine the influence of common dietary ingredients on the genome and attempts to relate the resulting different phenotypes to differences in the cellular and/or genetic response of the biological systems. Nutrigenetics, on the other hand, aims to study how the genetic makeup of an individual coordinates their response to diet and thus considers underlying genetic polymorphisms.

Objectives

The objectives of the course are to:

1. Explain the concept of nutrigenomics
2. Describe nutrigenetics.
3. Explain the importance of nutrition and its effects on gene expression.
4. Describe nutrient and gene interactions as they relate to disease prevention and intervention.
5. Explain the natural bioactive compounds

Learning Outcomes

On completion of this course, the student should be able to:

1. Describe the relationship between nutrigenomics, nutrigenetics.
2. Explain the relationship between nutrigenetics and health research

3. Interpret the different roles and importance of food and nutrition for the welfare of the community.
4. Plan diet.
5. Explain the information included on genetic tests and translate it into nutritional recommendations for patients.
6. Identify and explain the mechanism by which feeding habits affect gene expression and how this can be related to the onset of diseases

Course Contents

Introduction to Nutrigenomics and nutrigenetics. The complex partnership between Diseases and Nutrition, Cancer, diabetes, cardiovascular diseases and diets. Nutrigenomics: effects of nutrition on the genome. Nutrigenetics: genetic polymorphisms and individual response to specific diets. Nutritional approaches in management of infectious diseases. Relation between genetics and the development of some diseases such as chronic-degenerative, osteoporosis, neurological, obesity, insulin resistance and cardiovascular disease. Inborn errors of metabolism. MTHFR polymorphism and folate requirements. Familial Hypercholesterolemia. Taste receptors and sensory thresholds. Nutrigenomics & Nutraceuticals. Natural bioactive compounds. Epigenetic regulation. DNA methylation e.g. BPA and folic acid. Diet & Microbiome. Bioethic. Human evolution and nutrition.

Minimum Academic Standards

As found in 70% CCMAS.

GOU-BCH 413: Genetic Engineering and Biotechnology (3 Units; Compulsory; LH=30; PH=45)

Senate-Approved Relevance

Genetic engineering or the use of technologies to manipulate DNA, is revolutionizing our world today. From genetically modified vegetables designed to stay fresher longer and grow larger to the development of a synthetic human growth hormone, genetic engineering and biotechnology has and holds the potential to change the way we live. In this course, biochemistry students from Godfrey Okoye University will be knowledgeable about genome research, its benefits and risks and to explore the latest technologies in the field. In learning this course, the vision of Godfrey Okoye University to produce graduates who would be outstanding in learning will be achieved.

Overview

One of the biggest hurdles in scientific research is the possibility of errors or genetic defects, especially in humans. Scientists have a general understanding of what creates a functioning human, but they don't yet have all the pieces to the puzzle.

Biotechnology is a field of life science that uses living organisms and biological systems to create modified or new organisms or useful products. A major component of biotechnology is genetic engineering. Biotechnology would not be possible without genetic engineering. In modern terms, this process manipulates cells' genetic information using laboratory techniques in order to change the traits of living organisms. Genetic engineering is possible in all living cells; this includes micro-organisms such as bacteria and individual cells of multicellular organisms, such as plants and animals. Even the human genome can be edited using these techniques. The course is designed to provide the fundamental concepts of Genetic Engineering and Biotechnology (GEB) and its scope of application in various fields of biological sciences.

Objectives

The objectives of the course are to:

1. State and explain the basic concepts in Genetic Engineering and Biotechnology (GEB).
2. Describe sector-wise application of GEB.
3. Explain biotechnological applications GEB.
4. List and describe the areas pertinent to biotechnology.
5. Discuss the principles of biosafety and ethical perspectives of biotechnological systems.

Learning Outcomes

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

1. Explain at least five applications of biotechnology.
2. State and explain the fundamentals of recombinant DNA technology.
3. Describe the different mechanisms of genetic engineering and define genetically modified organisms.
4. Explain how genes are cut and ligated and how chimeric or recombinant cells are produced.
5. Explain the use of genetic engineering principles for gene targeting, transformation of plants and animals and production of hormones, insulin and biological insecticides.

Course Contents

Introduction to genetic engineering. Fundamentals of gene cloning and genetic engineering principles. Isolation of DNA and RNA from plant, animal and microbial cells (extraction of pure samples of DNA). Fragmentation of DNA, restriction endonuclease digestion, enrichment

for specific DNA sequences. Analysis of DNA fragment sizes. Joining DNA molecules together, cloning vectors- 122 types and characteristics. Selection of host cells. Introduction of DNA into the host cells. Transformation. Transduction. Conjugation. Transfection. Electroporation. Microinjection. Gene gun. Detection and analysis of successful clones, stability of cloned genes. Manipulation of cloned genes in vitro. Gene amplification. Gene knockout and disruption. Gene targeting. Genome editing. Clustered Regularly Interspaced Short Palindromic Repeats (CRISPR) technology. Genetically modified organisms. Genetic modification of industrial microorganisms. Insulin. Antibodies. Vaccines and hormone production technologies. Hormone replacement therapy. Genetic diagnosis and gene therapy. Transgenic animals. Transgenic plants. Transformation of plants using Agrobacterium tumefaciencs. Organic insecticide, Bacillus thuringiensis, FLAVR SAVR Tomato. The Human Genome Project, prospects and consequences.

Minimum Academic Standards

As found in 70% CCMAS.

GOU-BCH 414: Biochemical Pharmacology and Toxicology (2 Units; Elective; LH = 30; PH = 0)

Senate-Approved Relevance

Students completing the program will be well qualified to pursue entry-level scientific career employment in industry (e.g., biomedical; biotechnology; consumer products; contract research organizations; regulatory affairs; pharmaceutical), in academic basic science and clinical research laboratories, or in various agencies of government focused on science, health, or the environment. The program's depth and breadth has proved to be an excellent foundation for graduate work in pharmacology, toxicology, or other related biomedical sciences, as well as for medical school, veterinary medicine, and other health professions schools (e.g., pharmacy, dental, optometry, and public health). Knowledge of this course is in tune with Godfrey Okoye University's mission to produce graduates who excel in knowledge and character, and who are able to pursue epistemic dialogue in all its ramifications. It is also in tune with SDG 3 whose aim is to achieve universal health coverage, and provide access to safe and affordable medicines and vaccines for all.

Overview

Drug development plans need to incorporate innovative techniques such as preclinical models to study therapeutic strategies, and shift from sequential enrolment of subgroups, to more rational designs. To stimulate appropriate research plans, illustrations of specific pharmacokinetic/pharmacodynamics-related as well as drug safety-related challenges during drug development.

Both subjects (pharmacology and toxicology) integrate multiple scientific disciplines and rely on cutting-edge biotechnological approaches to gain insight into drug and toxicant action at the molecular level. Pharmacology and toxicology are related biomedical science disciplines. Pharmacology is the study of the sites, properties, effects, and mechanisms of drug action—the interactions of chemicals with biological systems. Toxicology addresses adverse effects of chemicals on humans and animals and includes exposure assessment, hazard identification, dose response assessment, and risk characterization.

Objectives

The objectives of the course are to:

1. Discuss critical concepts of pharmacological and toxicological relevance covered in-depth at a molecular and biochemical level, with the ultimate significance to the human organism.
2. Introduce bioanalytical techniques used in pharmacology and toxicology.
3. Explain drug metabolism, pharmacokinetics, an introduction to toxicology, carcinogenesis, mutagenesis and biochemical mechanisms of drug action.
4. Illustrate routes of drug administration.
5. Describe mechanisms of drug toxicity.

Learning Outcomes

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

1. Describe biochemical basis of the pharmacology of foreign substances.
2. State and explain the behaviour of the drug from its administration until its removal from the body and introduce them to general and systemic Pharmacology and its application to therapy.
3. Explain at least three theories of the mechanism of drug action.
4. Explain drug efficacy, drug resistance and drug toxicity.
5. Describe metabolic factors affecting chemotherapeutic agents.

Course Contents

Introduction to pharmacology. Origin and classification of drugs. Drug nomenclature. Drug modalities. Routes of Drug Administration. Drug Absorption. Distribution. Elimination. Mechanisms of drug action. Drug receptor and theories. Drug dosage and dose response curves. Relationship between drug efficacy and chemical structure. Drug screening, bioassay and toxicity. Drug resistances and other factors affecting drug efficacy. Pharmacogenetics. Toxic and lethal dosing. Mechanisms of drug toxicity. Drug discovery and design. Preclinical drug development. Clinical drug development. Measurement of some pharmacological parameters.

Minimum Academic Standards

As found in 70% CCMAS.

GOU-BCH 415: Nanoscience and Nanotechnology (2 Units; Compulsory; LH=30; PH = 0)

Senate-Approved Relevance

The field of nanoscience is a rapidly growing scientific domain. The goal is to introduce Godfrey Okoye biochemistry students to the applications of nanotechnologies in medicine and healthcare, especially in the areas of diagnostics, therapy and regenerative medicine. Nanoscience encompasses a diverse number of active pharmaceutical ingredients. Because of the fundamental role pharmacists will play in therapeutic and administrative decisions regarding nanoscience, it is imperative for Godfrey Okoye future biochemists to gain exposure early in their training to this rapidly evolving field.

Overview

A major technological revolution is with us now and we must align or be left out. Aligning with this emerging nanotechnology research tools for nano studies should be procured to equip the Godfrey Okoye biochemisty students so that advanced students are encouraged to conduct studies on nanosciences.

Nanoscience and nanotechnology provides a thorough overview of the exciting and emerging discipline of nanomedicine which is already starting to transform the way that medical and healthcare solutions are developed and delivered. The course will focus on the impact that nanotechnology has in the advance of medicine and healthcare including its role in delivery of therapy, tissue engineering and biosensing/diagnosis techniques, and will discuss how to progress this area to meet future needs. The course will be valuable to students seeking an introduction to current research and applications in the subject.

Objectives

The objectives of the course are to:

1. Explain the emerging field of nanoscience and to give an overview of present and future applications of nanotechnologies and nanomaterials in medicine and healthcare and their limitations.
2. Discuss the scientific and regulatory obstacles to implementation of nanoscience.
3. Present an overview of the distinctive features of nanotechnology and their application to biomedical problems.
4. Explain the applications of nanotechnologies to other field of work.
5. Describe recent developments in the safety of nanomaterials.

Learning Outcomes

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

1. Explain and discuss five advantages and challenges with nanomaterials in medical and pharmaceutical applications.
2. Describe transport mechanisms as well as passive and active targeting that control uptake of nano-based drug delivery systems via different administration routes.
3. Describe and critically evaluate different types of nano vehicles and nanocarriers as well as their use in nanoscience for disease diagnosis and therapy.
4. Describe pharmacokinetic.
5. Identify and explain regulatory aspects for the development of nano-based drug delivery systems.

Course Contents

Introduction to nanoscience. Challenges and opportunities in nanoscience. Introduction to nanotechnologies for medicine and healthcare. Challenges and opportunities in nanotechnology. Nanotechnology. Benefits of nanotechnology. Applications and Perspective. Recent developments in the safety of nanomaterials. Nanotechnologies and nanoparticles for drug delivery and therapy. Approaches to nanoparticle targeting. Principles in nanoscience. Emerging nanotechnologies and biomedical applications. Nanomaterials and classifications. Nanomaterials and nanotechnology-based drug delivery systems. Nano-based imaging and diagnostic systems. Nanotoxicology. Translating nanoscience into clinical investigation. Safety & risk issues associated with NanoTechnology. Pathway through nanotechnology.

Minimum Academic Standards

As found in 70% CCMAS.

GOU-BCH 416: Biostatistics (2 Units; Compulsory; LH=15; PH = 45)

Senate-Approved Relevance

The course aims to expose biochemistry students to the basic principles and methods of Biostatistics and to enable them to use different statistical and bio statistical analysis and packages for biological science and data interpretations and interference. Since the beginning of the century, the field of Biostatistics has become an indispensable tool in biological and medical sciences. The relevance of this course is seen in Biochemistry graduates from Godfrey Okoye University being able to acquire knowledge and expertise which will enable them to effectively address various challenges encountered in biological and medical sciences as well as in public health practices. Biostatics a field in information and communication technology – are crucial to achieving sustainable development and empowering our students (SDG 9).

Overview

Biostatistics is the application of statistical techniques to scientific research in the health related fields, including public health, medical and biological sciences. The purpose of this course is

to teach biochemistry students. The fundamental concepts and techniques of descriptive and inferential statistics with applications in biological and medical sciences and public health.
The training of students in this field will enable them acquire knowledge and skills that will be needed to transform data into useful information. Knowledge of biostatistics is essential for understanding and interpretation of modern scientific literature and active participation in the global research enterprise. Data is so crucial in the research field and processing that data spurs innovations in new treatments and medicines. It also helps us better predict the outcomes of public health issues and could even teach us how to see the beginnings of problems before they become a public health crisis. Biostatisticians are at the forefront of using big data to the advantage of human health.

Objectives

The objectives of the course are to:

1. State the principles of Biostatistics
2. Explain the concepts of frequency distribution sampling and experimental design.
3. Explain the determined level of confidence in a given biological data.
4. Compute correlation and regression.
5. Define analysis of variance (ANOVA) and test statistical hypothesis using ANOVA.
6. Explain the application of statistical methods and tools in biological and medical sciences.

Learning Outcomes

i. State the appropriate application and limitations of hypothesis testing and regression methods.
ii. Illustrate the appropriate graphical or tabular display for a given data set.
iii. Determine which statistical methods is/are most appropriate to analyze a given data.
iv. Analyze a given data using fundamental statistical methods.
v. Draw conclusions from statistical analysis and place them into the appropriate public health concepts.

Course Contents

Introduction to statistical methods. Statistical methods appropriate for biological and medical research. Basic principles of Biostatistics. Frequency distribution and sampling. Experimental design. Analysis of variance. Estimation and hypothesis testing. Correlation and regression. Elementary probability theory. Basic concepts of statistical inference. Regression and correlation. Level of confidence in biological data. Methods and sample size estimation. Statistical methods most appropriate to analyze a given data. Graphical or tabular display for a given data set. Biostatics applications to medical problems. Use of statistical packages. Conclusions from statistical analysis into the appropriate public health concepts.

Minimum Academic Standards

As found in 70% CCMAS.

GOU-BCH 417: Environmental Chemistry and Waste Management (3 Units; Compulsory; L = 45; PH = 0)

Senate-Approved Relevance

The study of our environment is very important for our survival. Activities carried out in our environment affect us directly or indirectly. Emissions discharged industrial plants and effluence released industries have adverse effect on the environment. To prepare biochemists that would be able to mitigate the problems of pollution in our environment, there is the need to introduce a course that deals with the chemistry of the environment. This course would equipped our graduates with adequate knowledge and skills to developed processes that would enable them cut down environmental pollution when setting up or working in chemical industries, thereby becoming good and trained environmental biochemists. Relevance is seen in Biochemistry graduates from Godfrey Okoye University being able to acquire skills and expertise in areas that affect societal health and wellbeing.

Overview of the course

The quality of life we live depends on the type of environment that surrounds us. A clean and healthy environment would lead to a healthier and wealthier live because health is wealth. A polluted and dirty environment would bring outbreak of sicknesses and diseases.

Emphasis shall be laid in the teaching of this course on the concepts of elementary cycles and characteristics of the atmosphere, sources, types and effects of environmental pollution. It shall also touch aspect of heavy metal and pesticides as pollutants and mutagenic and other effects of pollutants. The composition of different domestic wastes shall also be treated. More importantly water chemistry and analysis shall be carried out one some of the water bodies around us and lastly the chemical and physical methods in environmental pollution analysis would also be dealt with.

Objectives

The objectives of the course will include to:

Explain the meaning of environment in the context of chemistry**.**
Explain the meaning of environmental chemistry.
Describe the concept of elementary cycles.
State and explain the characteristics of atmosphere.
Mention and explain the sources, types and effect of environmental pollution.
Describe heavy metals and pesticides as pollutants.
Outline mutagenic and other effects of pollutants.
Identify and explain the composition of domestic waste and their management.
Describe the chemistry of water and analyze water samples.
Discuss the physical and chemical method of pollution analysis in our environment.
Explain industrial pollution.

Learning Outcomes

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

State and explain the correct meaning of environment in the context of chemistry.

Explain correctly the meaning of environmental chemistry.
Describe with three examples the concept of elementary cycles.
State and explain five characteristics of atmosphere.
Mention and explain three sources, three types and three effects of environmental pollution.
List and explain three examples of heavy metals and pesticides that could pollute the environment.
Describe three mutagenic effects of pollutants.
Identify and explain three components of domestic waste and three method they could be managed.
Analyze three samples of water.
List and explain three physical and three chemical methods of pollution analysis.
Mention and explain at least five types of industrial pollutions.

Course contents

Meaning of environment and meaning of environmental chemistry**.** Concepts of elementary cycles. Characteristics of the atmosphere. Sources of environmental pollution. Types of environmental pollution; Effects of environmental pollution. Heavy metal as pollutants. Pesticides as pollutants. Mutagenic and other effects of pollutants. Composition of domestic wastes. Water chemistry; Water analysis. Chemical methods in environmental pollution analysis; Physical methods in environmental pollution analysis. Industrial Pollution. Types of industries and their waste products. Dust and gas emitting industries. Cement. Metallurgical. Automobile. Mining. Solid waste industries, such as sugar, paper, food and rubber. Liquid and gaseous chemical wastes from chemical industries. Gas and oil spillage from petrochemical industries. Effects of industrial wastes on the environment. Effects on soil and water, plants and animals. Emission control technology, Electrostatic precipitators. Efficiency. Cyclones. Filters. Wet Scrubbers. Cement waste treatment. Metallurgical waste treatment. Mining industries. Solid waste treatment. Water as a medium for transport. Distribution of solid waste. Characteristics of industrial wastewater. Treatment of industrial wastewater including products from sewage sludge. Oil spillages.

Minimum Academic Standards

As found in 70% CCMAS.

Minimum Academic Standards

Equipment

1. Water Bath (Thermostatic)
2. Drying Oven (Thermostatic)
3. Spectrophotometers and Colorimeters
4. pH Meters
5. Electrophoresis Units
6. Centrifuges (Bench- Top & High Speed)

7. Incubators
8. Hot Plates and Heaters
9. Test-Tube Mixers
10. Gas Cylinders, Valves and Tubings
11. Distillers (All Glass)
12. Deionizers
13. Fraction Collector
14. Micro-Kedhjal Apparatus
15. Column Chromatography Equipment
16. Thin Layer Chromatography Equipment
17. Rotary Evaporator
18. Glass wares

Staffing

Professor/Reader	1
Senior Lecturer	2
Lecturers 1 and below	3 (at least 2 with PhD)
Laboratory Technologist	2
Laboratory Assistant	3
Laboratory Attendants	3
Secretary	1
Office Assistant	1

Library

The University Library is expected to stock at least 3 copies each hard-copy text books on biochemistry (both general and specialized), depending on number of students on the programme. There should also be hard copies of subject specific journals, both national and international. The library is also expected to subscribe to data bases that will make numerous text books and journals on biochemistry available as e-resources.

Classrooms, Laboratories, Workshops and Office Space The NUC recommends the following physical space requirements:

Description		**Size m^2**
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