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

Student Handbook

2023 - 2028

Overview

The programme has been designed to provide a sound understanding of the concepts of microbiology in relation to mankind and the environment. The programme will elaborate the importance of microorganisms and their products in industry (alcoholic beverages, petroleum and petrochemicals), health, food, agriculture, pharmacy and environmental sectors of the society. The Microbiology programmes will also emphasize the linkage between microbiology and biotechnology.

Philosophy

The philosophy is to train microbiology graduates who will apply microbiological procedures and techniques to solving developmental needs of the society.

Objectives

The objectives of the programme are to:
1. broadly train students for positions in the industry, health sector, research institutes; 2. prepare them for graduate and professional studies in applied areas of microbiology; and
3. develop their business skills in various aspects of Applied Microbiology.

Unique Features of the Programme

The programme includes a wider range and modern aspects (food, industrial, medical, systematics, pharmaceutical, environmental, petroleum, waste management, agricultural, biotechnology including genetic engineering and entrepreneurial) of microbiology.

Employability Skills

A graduate with degree in microbiology can provide opportunities in sectors such as private and government hospitals, technicians in private laboratories, forensic science laboratories, pharmaceutical industry, environmental management organisations, petroleum and petrochemical companies, agriculture, educational institutions, food processing industry, dairy industry, alcohol production, brewery industry, government regulatory agencies and non-governmental organisations (NGOs).
A degree in microbiology should equip the individual with technical, laboratory, scientific analytical and writing capacities with excellent interpersonal and communication skills. To ensure success the individual should have meticulous attention to detail and display a keen interest in treating and preventing diseases that are harmful to humans, proffer measures to monitor food quality, control food and material biodeterioration and enhance environmental quality.

21st Century Skills

1. critical thinking and problem solving
2. reasoning, analysis and interpretation
3. synthesising information
4. research skills and practices
5. problem solving,

6. interrogation and questioning.

Finally other skills emphasized are creativity, artistry, curiosity, imagination, innovation, personal expression perseverance, self-direction, planning, self-discipline, adaptability and initiative.

Admission and Graduation Requirements

Admission Requirements

Indirect entry

The entry requirements shall be at least credit level passes in five subjects including english language, mathematics, biology, chemistry, and physics at the senior secondary certificate (SSC) or its equivalent. In addition, an acceptable pass in the unified tertiary matriculation examination (UTME) is required for admission into 100-level.

Direct entry

Candidates with at least two A level passes GCE/IJMB/ JUPEB in two relevant subjects (biology, botany, chemistry, geography, mathematics and physics) may be admitted into 200-level, provided they satisfy the 'O' Level requirement.

Graduation Requirements

To be eligible for the award of a bachelor's degree in microbiology, a student must pass a minimum 120 units for those admitted through UTME and 90 units for direct entry.

Global 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 107	General Biology Practical I	1	C		45

CHM 101	General Chemistry I	2	C	30	-
CHM 107	General Chemistry Practical I	1	C		45
PHY 101	General Physics I	2	C	30	-
PHY 107	General Physics Practical I	1	C		45
BIO 102	General Biology II	2	C	30	-
Course Code	**Course Title**	**Unit(s)**	**Status**	**LH**	**PH**
BIO 108	General Biology Practical II	1	C		45
CHM 102	General Chemistry II	2	C	30	-
CHM 108	General Chemistry Practical II	1	C	-	45
PHY 102	General Physics II	2	C	30	-
PHY 108	General Physics Practical II	1	C	-	45
Total		**29**			

200 Level

Course Code	**Course Title**	**Units**	**Status**	**LH**	**PH**
GST 212	Philosophy, Logic and Human Existence	2	C	30	
ENT 211	Entrepreneurship and Innovation	2	C	15	45
MCB 221	General Microbiology	2	C	30	
MCB 231	Basic Techniques in Microbiology	2	C	30	
GOU-MCB 201	Management of Toxic Substances and Waste	1	E	15	30
GOU-MCB 210	Tropical plants Biotechnology	2	C	15	45
GOU-MCB 222	Spoilage Prevention and control of Root crops.	3	C	30	45
GOU-MCB 233	Management of Local Pests	2	C	15	45

GOU-MCB 243	Tropical Animals Biotechnology	2	C	45	45
GOU-MCB 245	Media preparation using various indigenous yam tubers	1	C	15	30
GOU-MCB 247	Biostatistics	2	C	30	-
GOU-MCB 258	Practical Biotechnology	2	E	15	45
	TOTAL	23			

300 Level

Course Code	Course Title	Units	Status	LH	PH
GST 312	Peace and Conflict Resolutions	2	C	30	
ENT 312	Venture Creation	2	C	30	
MCB 398	Entrepreneurship and Microbiology	1	C	15	
MCB 305	Fungi of Medical, Food and Industrial Importance	2	C	30	
MCB 307	Immunology	3	C	45	
MCB 399	Industrial Attachment II (12 Weeks)	3	C		
MCB 309	Food Microbiology	2	C	30	
MCB 322	Bacterial Diversity	3	C	45	
MCB 324	Microbial Ecology	3	C	45	
GOU-MCB 301	Coal Microbiology and Biotechnology	2	C	15	45
GOU-MCB312	Microbial Enzymes and Livestock Management	2	E	15	45
GOU-MCB 323	Tropical Soil Microbiology	2	C	15	45
GOU-MCB 334	Diagnostic Microbiology	3	C	30	45
GOU-MCB 335	Aquatic Microbiology	2	C	15	45
GOU-MCB 346	Basic Forensic Microbiology and metagenomics	2	C	15	45 -
	TOTAL	34			

400 Level

Course Code	Course Title	Units	Status	LH	PH
MCB 405	Principles of Epidemiology and Public Health Management	2	C	30	
MCB 407	Pathogenic Microbiology	3	C	45	
MCB 431	Petroleum Microbiology	2	C	30	
MCB 412	Microbial Genetics	3	C	45	
MCB 423	Industrial Microbiology	3	C	30	45
MCB 424	Microbial Physiology & Metabolism	3	C	45	
MCB 425	Environmental Microbiology	3	C	30	45
MCB 482	Virology & Tissue Culture	2	C	30	
MCB 491	Research Project	6	C		270
GOU-MCB 402	Seminar On Current Topics In Microbiology	2	C	30	-
GOU- MCB 413	Analytical Microbiology and Quality Control	3	C	30	45
GOU- MCB 424	Pharmaceutical Microbiology	3	C	30	45
	TOTAL	35			

Course Contents and Learning Outcomes

100 Level

GST 111: Communication in English **(2 Units C: LH 30; 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; classify word formation processes; construct simple and fairly complex sentences in English;
3. apply logical and critical reasoning skills for meaningful presentations;
4. demonstrate an appreciable level of the art of public speaking and listening; and
5. write simple and technical reports.

Course Contents

Sound patterns in English language (vowels and consonants, phonetics and phonology). English word classes (lexical and grammatical words, definitions, forms, functions, usages, collocations). Sentence in English (types: structural and functional, simple and complex). Grammar and Usage

(tense, mood, modality and concord, aspects of language use in everyday life). Logical and Critical Thinking and Reasoning Methods (Logic and Syllogism, Inductive and Deductive Argument and Reasoning Methods, Analogy, Generalisation and Explanations). Ethical considerations, Copyright Rules and Infringements. Writing Activities: (pre-writing, writing, post writing, editing and proofreading; brainstorming, outlining, paragraphing, types of writing, summary, essays, letter, curriculum vitae, report writing, note making etc. mechanics of writing). Comprehension Strategies: (reading and types of reading, comprehension skills, 3RsQ). Information and communication technology in modern language learning. Language skills for effective communication. Major word formation processes. Writing and reading comprehension strategies. Logical and critical reasoning for meaningful presentations. Art of public speaking and listening. Report writing.

GST 112: Nigeria 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 analyse the role of the Judiciary in upholding people's fundamental rights identify acceptable norms and values of the major ethnic groups in Nigeria; and
6. list and suggest possible solutions to identifiable Nigerian environmental, moral and value problems.

Course Contents

Nigerian history; culture and art up to 1800 (yoruba, hausa and igbo peoples and culture, peoples and culture of the ethnic minority groups). Nigeria under colonial rule (advent of colonial rule in Nigeria, colonial administration of Nigeria). Evolution of Nigeria as a political unit (amalgamation of Nigeria in 1914, formation of political parties in Nigeria. Nationalist movement and struggle for independence). Nigeria and challenges of nation building (military intervention in Nigerian politics, Nigerian Civil War). Concept of trade and economics of self-reliance (indigenous trade and market system; indigenous apprenticeship system among Nigeria people; trade, skill acquisition and selfreliance). 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 and 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, subsets, union, intersection, complements and use of Venn diagrams;
2. solve quadratic equations;
3. solve trigonometric functions;
4. identify various types of numbers; and
5. solve some problems using binomial theorem.

Course Contents

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

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

Learning Outcomes

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

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

Course Contents

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

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 lectures, students should be able to:

1. explain cells structures and organisations;
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 this course students should be able to:

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

Course Contents

Common laboratory hazards. Prevention and first aid. Measurements in biology. Uses and care of microscope. Compound and dissecting microscope. Biological drawings and illustration, scaling, accuracy and proportion. Use of common laboratory apparatus and laboratory experiments designed to illustrate the topics covered in **BIO 101.**

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

Learning Outcomes

At the end of this 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. And any 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, the 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 and chemical reactions. Modern electronic theory of atoms. Electronic configuration; periodicity and building up of the periodic table. Hybridisation and shapes of simple molecules. Valence Forces. Structure of solids. Chemical equations and stoichiometry. Chemical bonding and intermolecular forces. Kinetic theory of matter. Elementary thermochemistry, rates of reaction, equilibrium and thermodynamics. Acids, bases and salts. Properties of gases. Redox reactions and introduction to electrochemistry. Radioactivity.

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

Learning Outcomes

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

1. state the importance and development of organic chemistry;
2. define fullerenes and 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 in nanotubules, nanostructures, nanochemistry. Electronic theory in organic chemistry. Isolation and purification of organic compounds. Determination of structures of organic compounds including qualitative and quantitative analysis in organic chemistry. Nomenclature and functional group classes of organic compounds. Introductory reaction mechanism and kinetics. Stereochemistry. The chemistry of alkanes, alkenes, alkynes, alcohols, ethers, amines, alkyl halides, nitriles, aldehydes, ketones, carboxylic acids and derivatives. The Chemistry of selected metals and non-metals. Comparative chemistry of group IA, IIA and IVA elements.

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

Learning Outcomes

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

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

Course Contents

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

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 carrying out Chemical experiments;
3. identify the basic glassware and equipment in the laboratory;
4. identify and carry out preliminary tests which includes ignition, boiling point, melting point, test on known and unknown organic compounds;
5. perform solubility tests on known and unknown organic compounds;
6. conduct 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

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

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

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

1. describe the electric field and potential, and related concepts, for stationary charges;
2. calculate electrostatic properties of simple charge distributions using Coulomb's law, Gauss's law, and electric potential;
3. describe and determine the magnetic field for steady and moving charges;
4. determine the magnetic properties of simple current distributions using Biot-Savart and Ampere's law;
5. describe electromagnetic induction and related concepts and make calculations using Faraday and Lenz's laws;
6. explain the basic physical of Maxwell's equations in integral form;
7. evaluate DC circuits to determine the electrical parameters;
8. determine the characteristics of ac voltages and currents in resistors, capacitors, and Inductors.

Course Contents

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

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

Learning Outcomes

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

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

Course Contents

This introductory course emphasizes quantitative measurements, the treatment of measurement errors, and graphical analysis. A variety of experimental techniques should be

employed. The experiments include studies of meters, the oscilloscope, mechanical systems, electrical and mechanical resonant systems, light, heat, viscosity, etc., covered in PHY 101. However, emphasis is placed on the basic physical techniques for observation, measurements, data collection, analysis and deduction.

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

Learning Outcomes

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

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

Course Contents

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

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, etc.

ENT 211: Entrepreneurship and Innovation (2 Units C: LH15; 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 state the characteristics of an entrepreneur
2. analyse the importance of micro and small businesses in wealth creation, employment, and financial independence engage in entrepreneurial thinking;
3. identify key elements in innovation; describe stages in enterprise formation, partnership and networking including business planning;
4. describe contemporary entrepreneurial issues in Nigeria, Africa and the rest of the world; and
5. 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 join ventures). Contemporary entrepreneurship Issues (knowledge, skills and technology, intellectual property, virtual office, networking). Entrepreneurship in Nigeria (biography of inspirational entrepreneurs, youth and women entrepreneurship, entrepreneurship support institutions, youth enterprise networks and environmental and cultural barriers to entrepreneurship); basic principles of e-commerce.

MCB 221: General Microbiology (2 Units C: LH 15; PH 45)

Learning Outcomes

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

1. explain the basic concepts and scope of microbiology;
2. describe the layout of a microbiology laboratory, equipment and reagents in a microbiology laboratory; and
3. discuss the theory behind basic protocols in a microbiology laboratory.

Course Contents

History of the Science of Microbiology. Classification of organisms into prokaryotes and eukaryotes. Classification of prokaryotes into archaea and eubacteria. Anatomy and cytochemistry of bacteria and fungi; shapes, groupings and colonial morphology of bacteria and fungi. Structure of viruses. Sterilization and disinfection. Structure, ecology and reproduction of representative microbial genera. Culture of micro-organisms. Isolation of micro-organisms. Isolation of bacteria, viruses fungi (yeasts and moulds, nutrition and biochemical activities of micro-organisms. Antigens and antibodies. Identification and economic importance of selected microbial groups. Microbial variation and heredity. Study of laboratory equipment. Introduction to microbiology of air food, milk, dairy products, water and soil. Staining techniques, antibiotic sensitivity tests, serological tests, antimicrobial agents.

MCB 231: Basic Techniques in Microbiology

Learning Outcomes

At the end of the course, students will be exposed to

(2 Units C: PH 90)

1. the following techniques for the isolation of bacteria from soil, water, food and air;
2. process for obtaining pure cultures of bacteria and fungi;
3. techniques for the characterization and identification of bacterial isolates;
4. methods of bacteria enumeration; and
5. methods for the preservation of isolates and methods for culturing anaerobic bacteria

Course Contents

Culturing of micro-organisms. Preparation of media for microbial growth. Isolation of pure culture. Streaking, pour plates etc. Subculturing procedures. Staining techniques for differentiation of micro-organisms. Enumeration of micro-organisms, direct and indirect procedures. Identification of micro-organisms to include colonial and cellular morphology and biochemical procedures. Identification of bacteria should also include the use of serological techniques, antibiotic sensitivity discs and agar-in well methods. The use of anaerobic jar for growth of anaerobic organisms. Methods of preservation (agar slants, frequent subculturing, refrigeration and use of deep freezers, lyophilisation, storage in liquid nitrogen) of microbial cultures.

GOU-MCB 201: Management of Toxic Substances and Waste (1 Units; Elective; LH = 15; PH = 30)

Senate approved relevance

The goal of the course, management of toxicological and hazardous waste in microbiology, is to train graduates who are instilled with the knowledge of how to protect human health, the environment, comply with regulatory standards while preventing contamination, therefore promoting sustainability. This is in agreement with the vision of Godfrey Okoye University to become a center of academic excellence by effectively harnessing the available resources in the environment for teaching, research, community service, and sustainable economic development. The management of toxicological and hazardous waste in Enugu State ensures that such waste is safely handled, put to good use, transported, and disposed of, thus protecting the health of the people and the environment..

Overview

The field of microbiology for toxic substances and waste management involves understanding the physiology and metabolism of microorganisms and how they can be used to remediate contaminated sites. Researchers in this field focus on identifying and characterizing microorganisms that are capable of degrading specific toxic compounds, optimizing the conditions for microbial growth and activity, and developing bioremediation strategies that can be applied in the field. One key area of research in microbiology for toxic substances and waste management is bioremediation, which involves the use of microorganisms to break down or transform hazardous substances into non-toxic or less toxic forms. Bioremediation can be applied to a variety of environmental matrices, including soil, water, and air. Bioremediation techniques include bioaugmentation, which involves the addition of microorganisms to a contaminated site to enhance biodegradation, and biostimulation, which involves the modification of environmental conditions to stimulate the growth and activity of naturally occurring microorganisms.

Another area of research in microbiology for toxic substances and waste management is microbial fuel cells, which use microorganisms to generate electricity from organic matter. These fuel cells have potential

applications in the treatment of wastewater and the production of renewable energy. Overall, studying the management of toxic substances and waste in microbiology is important for developing sustainable and environmentally friendly solutions to the problems of hazardous waste disposal and remediation. It involves an interdisciplinary approach that combines microbiology, chemistry, and engineering to address complex environmental problems.

Objectives

The course will have the following objectives;

1. To define hazardous waste and substances.
2. To list and classify and characterize hazardous substances.
3. To Identify and discuss hazardous waste and substances.
4. To analyze hazardous and toxic substances.
5. To identify and explain the sources of Hazardous waste.
6. To explain and apply the regulations and laws governing the sale, importation, transportation, storage and disposal of hazardous and toxic substances.
7. To discuss various bioremediation technologies.

Learning outcomes

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

1. Identify different types of hazardous waste based on their characteristics and potential risks to human health and the environment.
2. Differentiate between types of hazardous waste based on their characteristics and potential risks to human health and the environment
3. Interpret the legal and regulatory frameworks for managing hazardous waste in Enugu state,
4. Conduct risk assessments of hazardous waste sites and develop effective risk management strategies, including measures to prevent or mitigate the release of contaminants into the environment.
5. State the roles of different government agencies and the requirements for obtaining permits and licenses.
6. Identify opportunities for waste minimization and recycling, such as by implementing source reduction measures and developing innovative recycling.

Course content

The nature origin and classification of hazardous toxic substances. Characteristics of wastes and hazardous substances. Identification of hazardous substances. Sources and pathways of hazardous substances. Disposal methods and technology of hazardous substances. Geological environmental factors affecting choice of disposal site. Contamination of water bearing strata, soil, plants, food webs and bio-concentration. Analysis of hazardous and toxic substances. Environmental and health impacts of hazardous waste. Microorganisms and hazardous waste. Microbial metabolism and biodegradation of hazardous waste. Factors influencing microbial activity and degradation rates. Microbial communities and their role in waste management. Bioremediation technologies. Types of bioremediation technologies and their applications. Microbial fuel cells. Principles of microbial fuel cells. Regulations and law governing the sale, importation, transportation, storage and disposal of hazardous and toxic substances.

Minimum Academic Standards requirements and equipment

As are present in the 70% CCMAS.

GOU-MCB 210: Tropical Plants Biotechnology (2 Units; Compulsory; LH = 15; PH = 45)

Senate approved relevance

Microbiology students who study Tropical plants Biotechnology become relevant in highly skilled in their field because they can learn about the different plants they see around them and know different plant-derived compounds that have several properties. They can also learn about the mechanisms by which these compounds interact with microorganisms, including their effects on cell membranes, enzymes, and other molecular targets. This understanding can help microbiology students to develop new strategies for combating pathogenic microorganisms, as well as to promote sustainable agricultural practices and the development of new biotechnological applications. The course, Tropical plants Biotechnology, is in agreement with the vision of Godfrey Okoye University to become a center of academic excellence by effectively harnessing the available resources in the environment for teaching, research, community service, and sustainable economic development. This is particularly important in Enugu, as it is home to a diversity of economic relevant plants.

Overview

Tropical plants Biotechnology is a branch of biology that deals with the study of plants that have economic or cultural value. It encompasses a wide range of topics, including the identification, classification, and use of plants for food, medicine, fiber, fuel, and other purposes. One area of interest in Tropical plants Biotechnology for microbiologists is the study of plant-microbe interactions, particularly the interactions between plant roots and soil microbes.

These interactions are important for plant growth and productivity, and can have significant economic implications for agriculture and horticulture. Another area of interest for microbiologists in Tropical plants Biotechnology is the use of microbes in biotechnology, particularly in the production of biofuels, pharmaceuticals, and other products. Microbes such as bacteria, fungi, and algae can be used to produce a wide range of compounds, such as enzymes, antibiotics, and biofuels, which can have economic value.

Objectives

The objectives of the course are to:

1. Identify and describe plant species and their uses for food, medicine, fiber, and other products.
2. Identify the diversity of plant species and their ecological and economic importance in different regions.
3. List the chemical and biochemical properties of plant compounds and their use in medicine, industry, and other applications.
4. Explain the genetic diversity of plants and their potential for crop improvement and breeding.
5. Explain the interaction between plants and microorganisms and their role in agricultural productivity and sustainability.
6. List the nutritional properties of plants and their contribution to human and animal diets.
7. Explain the historical and cultural significance of plants in different regions and societies.
8. List and explain the environmental impact of plant-based industries and to develop more sustainable practices and policies.
9. To explain how the knowledge of economic botany will help to address global issues such as food security, health, and biodiversity conservation.

Learning outcomes

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

1. Identify various types of plant species in Enugu and their uses for food, medicine, fiber, and other products.
2. Explain the ecological and economic importance of plant species in Enugu and different cities/regions and the interdependence of plants and humans.
3. Identify and describe plant species and their characteristics, including their morphology, anatomy, and biochemical properties.
4. List the chemical and biochemical properties of plant compounds and their use in medicine, industry, and other applications.
5. Identify genetic diversity of plants and their potential for crop improvement and breeding.
6. Describe the interaction between plants and microorganisms and their role in agriculture, environmental sustainability, and human health.
7. Enumerate the nutritional properties of plants and their contribution to human and animal diets.
8. List the cultural and historical significance of plants in Enugu and in different regions and societies.
9. Explain how tropical plants Biotechnology would help to address global issues such as food security, health, and biodiversity conservation.

Course content

Definition of Tropical plants Biotechnology. A study of Nigerian vegetation types: mangrove, swamp forest, fresh water swamp forest, savannah grass lands and arid zones. Importance of plants in human culture. Health, and economic importance. Study of Plants products used in local industries. Various ways in which plants and plant products are utilized in modern industries. Plants as sources of technical raw materials. The dependency of man on plant kingdom. Plant tissue culture. Basic principles of plant genetic diversity and their potential for crop improvement. Biotechnology and genetic engineering for plant-based product development. Plant-Microbe Interactions. Agriculture and Environmental Sustainability. Plant-based solutions for environmental challenges. Plants producing oils, rubber and wood products, fibres, dyes and leather tanning materials, sugar and pharmaceutical products. Biodiversity conservation and plant diversity. Economic and social aspects of plant-based industries. Application of Tropical plants Biotechnology in research and industry. Career opportunities in Tropical plants Biotechnology.

Minimum Academic Standards requirements and equipment

As are contained in the 70% CCMAS.

GOU-MCB 222: Spoilage Prevention and Control of Root Crops (3 Units; Compulsory; LH = 30; PH = 45)

Senate approved relevance

In line with Godfrey Okoye University's mission to produce graduates that are not only employers of labour but also consultants to many organizations, Yam Tuber and other Root Crops Pathology and control as a course, will help to produce sound graduates who understand the causes of indigenous yam tuber and root crops diseases and is able to develop strategies for managing the spread of the diseases by understanding plant-microbe interactions, thereby ensuring sustainable agriculture practices and productivity of our food systems and natural ecosystems.

Overview

Spoilage Prevention and Control of Root Crops, especially the Yam tuber, refers to the study of diseases that affect yam tubers and other root crops, which are an important source of food in many parts of Nigeria and Africa. Several microorganisms, including fungi, bacteria, and viruses, can cause yam tuber diseases, leading to reduced crop yield and poor tuber quality. Effective control measures for these diseases are therefore essential to ensure food security and promote sustainable agriculture.

Control measures for root crops and yam tuber diseases involve a combination of cultural, biological, and chemical methods. Cultural practices such as crop rotation, weed control, and use of disease-free seed tubers can help to prevent the spread of yam tuber diseases. A combination of Biological, Chemical and cultural control can be effective in managing such diseases. Yam tuber pathology is an important field of study in microbiology as it provides insights into the causes and control measures for diseases that affect yam tubers and their proper implementation to ensure sustainable agriculture and food security.

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Objectives

The course will have the following objectives to:

1. Identify the causative agents of different indigenous root crops and yam tuber diseases.
2. List and explain the mechanisms of disease development.
3. Identify the microbial agents responsible for causing disease.
4. Develop control strategies to prevent or manage diseases in yam tubers.
5. Evaluate the effectiveness of various control measures under different conditions.
6. Analyze the yam tuber quality and yield.
7. Analyze the cassava and cocoyam quality and yield.

Learning outcome

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

1. List the causative agents of Yam and other root crops diseases
2. Identify common yam diseases, including those caused by fungi, bacteria, viruses, and other pathogens.
3. Describe the life cycle of yam and cocoyam pathogens.
4. Explain the various disease management strategies

5. Evaluate yam and cocoyam health by assessing their symptoms, appearance, and other indicators.
6. Design experiments, collecting and analyzing data, and interpreting results.
7. Apply the knowledge of root crops and especially yam pathology in agricultural settings to improve crop yield, reduce losses due to disease, and promote sustainable agriculture practices.

Course outline

Introduction to Root Crops Spoilage Prevention and Control. Overview of Prevention of Root Crops Spoilage. Prevention of yam tuber spoilage and its economic impact. Study of yam diseases caused by bacteria, fungi, viruses, nematodes from local environment. Factors that contribute to yam tuber spoilage (biological, environmental, mechanical). Basic principles of yam tuber preservation and control. Types of microorganisms that cause yam tuber spoilage. Factors that affect microbial growth on yam tubers. Strategies for controlling microbial spoilage of yam tubers (e.g. use of fungicides, sanitizers, modified atmosphere packaging). Mechanism of microbial pathogenesis and disease resistance to include consideration of genetics of microbial pathogenesis. Selected Root crops and yam tuber diseases. Types of physical and mechanical damage that can lead to the spoilage of Root Crops (e.g. cuts, bruises, impacts). Effects of physical and mechanical damage on yam tuber quality and shelf life. Techniques for minimizing physical and mechanical damage during harvesting, handling, and storage. Assessment of disease severity and estimation of losses. Yam Tuber Preservation in Rural and Urban Areas. Differences in yam tuber preservation practices between rural and urban areas. Challenges and opportunities for yam tuber preservation in each context. Techniques and strategies for promoting yam tuber preservation and reducing spoilage in both rural and urban areas.

Minimum Academic Standards requirements and equipment

As are present in the 70% CCMAS

GOU-MCB 233: Management of Local Pests (2 Units; Compulsory; LH = 15; PH = 45)

Senate approved relevance

Pest Management is an approach to managing pest populations that integrates multiple control methods, such as cultural, biological, and chemical controls, to reduce pest damage while minimizing the negative impact on the environment and non-target organisms. As such, the study of pest management is highly relevant to microbiologists, as they play an important role in the training of graduates who are highly skilled in the development and implementation of pest management strategies. This is in accordance with the vision of Godfrey Okoye University to be a centre of academic excellence by utilizing the available resources in the environment for teaching, research, community service and sustainable economic development.

Overview

Local Pest Management is an approach to pest control that seeks to minimize the use of chemical pesticides and other harmful practices, while still managing pest populations effectively. As a result Local Pest Management has become an important area of study for microbiologists, who play a crucial role in developing and implementing sustainable pest management strategies. One of the key principles of Local Pest Management is to use a combination of different pest control methods that are targeted, efficient, and environmentally friendly. Microbiologists contribute to Pest Management by studying the interactions between pests and their natural enemies, such as predators, parasitoids, and pathogens. They also develop and test biological control methods, such as the use of beneficial insects, nematodes, and microorganisms, which can help to reduce pest populations without the use of harmful chemicals.

Overall, the study of Management of Local Pests is an important area of research for microbiologists, as it provides insights into the interactions between pests, their natural enemies, and the environment. By developing sustainable and effective pest management strategies, microbiologists can contribute to the protection of crops, the environment, and human health.

Objectives

It has the following objectives, to:

1. Identify the different types of pests that can cause damage to crops
2. Describe them based on their properties and characteristics.
3. Describe the life cycles, biology, and behavior of pests, which can help to develop strategies for their management.
4. Identify biological control methods to determine their effectiveness and to optimize their use in Local Pest management programs.
5. Identify and test cultural and physical control methods
6. Identify and test chemical control methods
7. Identify strategies for resistance management control methods, and develop strategies for preventing or delaying the development of resistance in pest populations.
8. Identify the appropriate control measure to adopt.

Learning outcomes

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

1. Outline the principles of local pest management, which involves using a combination of strategies to manage pests in a way that minimizes negative impacts on the environment and human health.
2. Identify and classify different types of pests based on their biology, morphology, and behavior.
3. Explain the life cycles, feeding habits, and behavior of pests.
4. Explain the use of natural enemies, such as predators, parasites, and pathogens, as biological control agents for pests.
5. Develop and test cultural and physical control methods such as crop rotation, sanitation, and mechanical controls, which can help to reduce pest populations.
6. Describe the use of chemical pesticides as a control method for pests, while also identify the potential risks and benefits associated with their use.
7. Develop and present implement strategies to prevent or delay the development of resistance in pest populations, which can help to maintain the effectiveness of control methods over time.

Course outline

Introduction to Local Pest Management. Overview of common pests found in local environments. Role of microbiology in pest management. Importance of local pest management for sustainable agriculture and public health. Principles of Pest Identification and Monitoring. Techniques for identifying pests and their life cycles. Strategies for monitoring pest populations. Tools and methods for effective pest surveillance. Integrated Pest Management Strategies. Definition and principles of integrated pest management (IPM). Importance of cultural, biological, and chemical control methods. IPM decision-making process and implementation. Microbial Control of Pests. Introduction to microbial control agents and their modes of action. Use of bacteria, fungi, viruses, and other microorganisms for pest control. Case studies of successful microbial pest control. Plant-Microbe Interactions and Pest Management. Overview of plant-microbe interactions and their role in pest management. Use of plant-microbe interactions for pest control. Insect-Pathogen Interactions and Pest Management. Overview of insect-pathogen interactions and their role in pest management. Use of insect-pathogen interactions for pest control. Environmental and Human Health Considerations in Pest Management. Importance of environmental and human health considerations in pest management. Methods for minimizing environmental impact and human health risks. Regulations and guidelines for safe and effective pest management. Analysis of local pest management strategies in different regions and ecosystems. Evaluation of their effectiveness and sustainability. Development of a local pest management plan for a specific region or ecosystem.

Minimum Academic Standards requirements and equipment

As are defined in the 70% CCMAS

GOU-MCB 243: Tropical Animals Biotechnology (2 Units; Compulsory; LH = 15; PH = 45)

Senate approved relevance

Tropical Animals Biotechnology provides a broad perspective on the relationship between animals, microorganisms, and human societies, and can help microbiologists to understand the ecological and economic factors that influence the distribution and transmission of microorganisms. Which is in harmony with the visions of Godfrey Okoye University as a center of academic excellence by means of utilizing the available resources in the environment for teaching, research, community service and sustainable economic development.

Overview

Tropical Animals Biotechnology aids a microbiologist in understanding the relationship between animals and microorganisms in various ecological and economic systems.Tropical Animals Biotechnology is concerned with the study of animals and their relationship with humans, including their role in agriculture, food production, disease transmission, and the environment. In the context of microbiology, Tropical Animals Biotechnology can help microbiologists to understand the impact of animals on the transmission and spread of microbial diseases. For example, many zoonotic diseases, such as avian influenza and Lyme disease, are transmitted from animals to humans through microorganisms.

By studying the ecology of animal populations and their interactions with microorganisms, microbiologists can gain insights into the emergence and spread of infectious diseases. Tropical Animals Biotechnology can also provide insights into the use of animals in biotechnology and the production of microbial products. For example, certain animals, such as insects and marine organisms, are sources of unique and valuable microorganisms that have potential applications in biotechnology, including drug discovery and industrial production.

Objectives

The objectives of the course are to:

1. Describe the ecological and epidemiological factors that contribute to the emergence and spread of zoonotic diseases.
2. Identify strategies for their control and prevention.
3. Identify and characterize microorganisms that have potential applications in biotechnology, medicine, and other fields.
4. Develop methods for their isolation, cultivation, and production.
5. Investigate the impact of animal husbandry practices on microbial ecosystems.
6. Analyze the economic and social costs and benefits of animal-microbe interactions in different contexts, including agriculture, food production, and disease control.
7. Develop policies and management strategies that promote sustainable and equitable outcomes.

Learning outcomes

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

1. Develop an understanding of the ecological and epidemiological factors that contribute to the emergence and spread of zoonotic diseases, and the role of animals in their transmission.

2. Identify and characterize microorganisms that have potential applications in biotechnology, medicine, and other fields
3. Explain the methods for their isolation, cultivation, and production.
4. Analyze the effects of animal husbandry practices on the composition and activity of microbial communities associated with animals.
5. Evaluate the potential of sustainable and environmentally friendly approaches to animal production.
6. Assess the economic and social costs and benefits of animal-microbe interactions in different contexts, including agriculture, food production, and disease control.
7. Analyze strategies for promoting sustainable and equitable outcomes

Course outline

Introduction to tropical animal biotechnology. Principles and applications of genetic engineering in tropical animal research. Applications of zoological knowledge for benefits of mankind. Culturing of animals for mass production for human use. Control or eradication of animals that are injurious to man directly or indirectly, aquaculture techniques. Molecular biology techniques used in tropical animal research. Regulation of gene expression in tropical animals. Functional genomics techniques to study the roles of genes and proteins in tropical animal physiology and behavior. Principles and applications of proteomics in tropical animal research. Principles and applications of metabolomics in tropical animal research. Introductory bioinformatics tools and databases to analyze and interpret large-scale genomic and proteomic data sets. Bioremediation and its application in the management of environmental pollutants in tropical animal habitats. Principles and applications of biopharmaceuticals in tropical animal research. Applications of nanobiotechnology in tropical animal research. Use of biotechnology in the conservation of endangered tropical animal species. Ethical and regulatory considerations in biotechnology research involving tropical animals, including the responsible use of animals in research and the regulation of genetically modified organisms

Minimum Academic Standards requirements and equipment

As are contained in the 70% CCMAS.

GOU-MCB 245: Media Preparation Using Indigenous Yam Tubers (1 Unit; Compulsory; LH = 15; PH = 30)

Senate approved relevance

In agreement to the visions of Godfrey Okoye University to be a center of academic excellence by utilizing the available resources in the environment for teaching, research, community service and sustainable economic development, the use and evaluation of different local foods as potential sources of microbial culture media is to develop sustainable and cost-effective alternatives to commercial culture media. Traditional media used for culturing microorganisms, such as agar, can be expensive and may not be readily available in some areas. By identifying local foods that can be used as sources of nutrients for microbial growth, it is possible to reduce the cost of culture media and increase access to microbial technology in resource-limited settings.

Overview

The use of locally sourced materials can help to promote sustainable practices and support local economies. Evaluation of different local foods as potential sources of microbial culture media can also lead to the discovery of novel microorganisms with unique properties that may have potential applications in areas such as biotechnology, medicine, and food production.

Overall, the relevance of this research is to provide an alternative and sustainable approach to culturing microorganisms, which can lead to advancements in various fields of microbiology.

Objectives

The objectives of the course are to:

1. Identify locally available materials that can be used as sources of nutrients for microbial growth.
2. Evaluate the efficacy of different local foods as culture media for different types of microorganisms including bacteria, fungi, and viruses.
3. Develop and present alternatives to commercial culture media that may be expensive or difficult to find, in order to ensure the provision of cost-effective and sustainable culture media for microbial growth.
4. Evaluate its support to local economies and the promotion of sustainable practices by utilizing locally available materials.
5. Identify and explain novel microorganisms with potential applications in biotechnology, medicine, and food production

Learning outcomes

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

1. Explain the nutritional requirements of microorganisms and how different local foods can provide these nutrients for microbial growth.
2. Identify the different types of microorganisms that can be cultured using local foods as culture media and understand the optimal conditions required for growth.
3. Skillfully prepare and sterilize different types of local foods for use as microbial culture media.
4. State the principles of microbial growth kinetics and the factors that influence microbial growth in different types of culture media, including local foods.
5. Evaluate the efficacy of different local foods as culture media for microbial growth

6. Compare using practical skills, different local foods and microbes grown with them to microbes grown on commercial culture media.
7. Identify and characterize microorganisms cultured using local foods as culture media, including the use of biochemical tests and microscopy.
8. Identify potential applications of microorganisms cultured using local foods as culture media in various fields, including biotechnology, medicine, and food production, and understand the importance of continued research and innovation in this area

Course outline

Introduction to Indigenous Yam Tubers. Evaluation of different local foods such as cocoyam, yam (local yam species like, *Adu* and *Ona*) as potential sources of microbial culture media, Cocoyam (ede bu ji, Edeko) (*Xanthosomas saggittifolium*), White yam (*Dioscorea rotundata*), Ede (Taro) (*Colocasia exculenta*)., Yellow yam (ona) (*Dioscorea dumentorum*), Adu (bulb yam) Dioscorea bulbifer. Isolation of various types of microorganisms including bacteria and fungiSelection and Preparation of Yam Tubers. Media Preparation Techniques. Nutrient Composition of Yam Tubers. Optimization of Media Composition. Sterilization Techniques. Quality Control measures used in media preparation with indigenous yam tubers. Visual inspection. pH testing. Microbial testing. Preservation Techniques. Applications of Yam-based Media. Different applications of yam-based media in microbiology research. Cultivation of bacteria, fungi, and other microorganisms. Development of novel media formulations and the optimization of media preparation techniques for specific microorganisms.

Minimum Academic Standards requirements and equipment

As are present in the 70% CCMAS.

GOU-MCB 247: Biostatistics (2 Units; Compulsory; LH = 30)
Senate approved relevance

Biostatistics enables researchers and Microbiologist to make evidence-based decisions. By providing the tools and techniques to analyze and interpret data from microbiological-related studies, biostatistics helps to identify patterns and relationships in the data, make inferences about populations, and draw conclusions based on empirical evidence. This is especially important for the training of quality graduates, who are experts in biostatistics. This is in line with the vision of Godfrey Okoye University to be a centre of academic excellence by utilizing the available resources in the environment for teaching, research, community service and sustainable economic development. Biostatistics plays a crucial role in helping to ensure that decisions are based on sound scientific evidence and not just intuition or guesswork**.**

Overview

Biostatistics is the application of statistical methods to biological, medical, and public health research. It involves designing studies, collecting data, analyzing the data, and interpreting the results to draw conclusions about populations. Biostatistics is an essential tool for scientists and researchers to understand the patterns, trends, and associations within complex biological data sets.

The field of biostatistics is crucial in the development of new medical treatments, understanding disease outbreaks, and improving public health policies. Biostatisticians use statistical methods to identify risk factors for disease, evaluate the effectiveness of medical interventions, and assess the impact of public health initiatives. Biostatistics is an interdisciplinary field that draws from mathematics, biology, medicine, and public health to help us understand the biological and health-related phenomena that surround us.

Objectives

It has the following objectives, to:

1. Describe and summarize data related to microbiology.
2. Analyze populations based on data collected from samples.
3. Determine and present appropriate sample sizes,
4. Illustrate with designs the methods of data collection.
5. Analyze and interpret data from microbiologically elated studies, including clinical trials, epidemiological studies, and observational studies.
6. Evaluate the effectiveness of interventions and making predictions about microbiological outcomes.

Learning Outcomes

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

1. Explain the scope for statistical methods in biology and Microbiology
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 between point and interval estimation which could be used 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
6. Explain the elements of design of experiments and analysis of variance.

Course Contents

Definition of biostatistics. Importance of biostatistics in microbiological research. Types of data in biostatistics. Scope for statistical methods in Microbiology and Biology. 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). 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. Regression Analysis. Survival Analysis. T-test and nonparametric methods. One-way ANOVA. Multiple comparison tests. Sample Size Determination: power analysis, estimation of sample size. Study Design; randomization and blinding, types of study design, confounding and interaction. Statistical Software; introduction to R, data visualization.

Minimum Academic Standards Requirements:

The Minimum Academic Standards requirements and equipment needed to teach biostatistics in a university may vary depending on the level of the course and the university's resources. However, the following are some general requirements and equipment that are typically needed to teach biostatistics effectively:

1. Access to a well-equipped computer laboratory with statistical software such as R, SAS, or SPSS.
2. Access to a library with a collection of biostatistics textbooks, reference books, and journals.
3. A grading system and assessment methods that accurately reflect the students' understanding and mastery of the course material.
4. A computer projector or other presentation equipment to display slides, graphs, and statistical analysis output during lectures.
5. Access to online learning platforms and digital resources to supplement classroom instruction.
6. Statistical analysis software such as R, SAS, or SPSS installed on computers in the computer laboratory.

GOU-MCB 258: Practical Biotechnology (2 Units; Elective; LH = 15; PH = 45)

Senate approved relevance

The study of practical biotechnology is a valuable tool for graduate microbiologists to harness the power of microorganisms in the environment for a wide range of applications, from improving food and agriculture to developing new medicines and environmental solutions. This is in agreement to the visions of Godfrey Okoye University to be a center of academic excellence by utilizing the available resources in the environment for teaching, research, community service and sustainable economic development.

Overview

Practical biotechnology is the application of scientific techniques and principles to develop useful products and processes. This field encompasses a wide range of areas including agriculture, medicine, environmental science, and industrial biotechnology. Practical biotechnology utilizes living organisms or their products to create solutions to real-world problems. Some examples of practical biotechnology applications include genetically modified crops that can resist pests and diseases, production of biopharmaceuticals such as insulin and vaccines, and development of enzymes and other bio-based products for industrial use.

Practical biotechnology is a rapidly growing field with immense potential to transform various aspects of our lives. The development of new and innovative biotechnologies is opening up new possibilities for sustainable agriculture, disease treatment, and environmental remediation. The application of biotechnology in the production of biofuels and other renewable energy sources is also providing solutions to the world's energy needs.

Objectives

The course will have the following objectives, to:

1. Identify microorganisms used to develop new products such as enzymes, antibiotics, biofuels, and specialty chemicals.
2. Analyze and optimize the production of existing products, such as increasing yields and reducing production costs.
3. Apply the principles of bioremediation to environmental problems, such as using microorganisms to clean up contaminated soils, water, and air.
4. Describe how agricultural productivity will be improve by developing microbial inoculants, which can improve plant growth, increase nutrient uptake, and protect plants from diseases.
5. Outline the steps taken to modify the genetic makeup of microorganisms, enabling them to produce new compounds or to perform new functions.
6. Apply the principles of biotechnology in the development of new drugs, vaccines, and diagnostic tests based on microorganisms, such as bacteria and viruses. This can help to treat and prevent diseases, as well as improve public health.

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

1. Explain and carry out laboratory techniques procedures, including sterilization, culture media preparation, and inoculation techniques. Students should be able to perform these techniques accurately and safely.
2. Demonstrate the Practical knowledge of genetic engineering techniques, such as PCR, gene cloning, and DNA sequencing and have a good understanding of these techniques and be able to use them effectively.
3. Analyze and interpret biological data.
4. Design experiments that are scientifically rigorous, and have the skills to conduct experiments safely and accurately.
5. Apply the regulations and ethical principles that govern biotechnology research in their work.
6. Explain clear scientific reports and communicate findings to others and able to communicate their findings clearly and effectively in both written and oral formats.

Course outline
Historical development and significance of biotechnology. Microscopic examination of cells, measurement of cell size using micrometer. Measurement of cell concentrations (microscopic enumeration, fresh weight, dry weight, packed cell volume); Autoclaving; using the pipette. Different methods of DNA extraction from living organisms. The Thermal cycler. Gel electrophoresis. Genetic Engineering Techniques. Microbial Biotechnology. Plant Biotechnology; plant tissue culture and regeneration, transgenic plant development, applications of plant biotechnology in agriculture. Animal Biotechnology; animal cell culture and cloning, transgenic animal development. Biopharmaceuticals. Biosensors. Synthetic Biology. Bioethics and Regulatory Issues. Emerging Trends in Biotechnology; nanobiotechnology, stem cell research, synthetic biology and genetic engineering. Biotechnology and Medicine. Development of biopharmaceuticals and vaccines. Gene therapy and genetic testing.

Minimum Academic Standards requirements and equipment
As are present in the 70% CCMAS.

300 Level

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

Learning Outcomes
At the end of the course, students should be able to
1. analyse the concepts of peace, conflict and security;
2. list major forms, types and root causes of conflict and violence;
3. differentiate between conflict and terrorism;
4. enumerate security and peace building strategies; and

5. describe roles of international organisations, media and traditional institutions in peace building.

Course Contents

Concepts of Peace, conflict and security in a multi-ethnic nation. Types and theories of Conflicts: ethnic, religious, economic, geo-political conflicts. Structural conflict theory, realist theory of conflict, frustration-aggression conflict theory. Root causes of conflict and violence in Africa: indigene and settlers' phenomenon. Boundaries/boarder disputes. Political disputes. Ethnic disputes and rivalries. Economic inequalities. Social disputes. Nationalist movements and agitations. Selected conflict case studies – Tiv-Junkun. Zango Kartaf. Chieftaincy and land disputes etc. Peace building, management of Conflicts and Security: Peace & human Development. Approaches to peace & conflict management --- (Religious, Government, Community Leaders etc.). Elements of peace studies and conflict resolution. Conflict dynamics assessment scales: constructive & destructive. Justice and legal framework. Concepts of social justice. The Nigeria legal system. Insurgency and terrorism. Peace mediation and peace keeping. Peace & security council (international, national and local levels) gents of conflict resolution – conventions, treaties Community Policing. Evolution and imperatives. Alternative Dispute Resolution, ADR. Dialogue b). Arbitration, c). Negotiation d). Collaboration etc. Roles of international organizations in conflict resolution. (a). The United Nations, UN and its conflict resolution organs. (b). The African Union & peace security council (c). ECOWAS in peace keeping. Media and traditional institutions in peace building. Managing post-conflict situations/crisis: Refugees; internally displaced persons, IDPs. The role of NGOs in post-conflict situations/crisis.

ENT312: Venture Creation **(2 Units C: LH 30; 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; spot opportunities in problems and in high potential sectors regardless of geographical location;
2. state how original products, ideas, and concepts are developed;
3. develop business concept for further incubation or pitching for funding;
4. identify key sources of entrepreneurial finance;
5. implement the requirements for establishing and managing micro and small enterprises;
6. conduct entrepreneurial marketing and e-commerce;
7. apply a wide variety of emerging technological solutions to entrepreneurship; and
8. appreciate why ventures fail due to lack of planning and poor implementation.

Course Contents

Opportunity identification (sources of business opportunities in Nigeria, environmental scanning, demand and supply gap/unmet needs/market gaps/market research, unutilised resources, social and climate conditions and technology adoption gap). New business development (business planning, market research); entrepreneurial finance

(venture capital, equity finance, Micro finance, Personal savings, small business investment organizations and Business plan competition). Entrepreneurial marketing and e-commerce (principles of marketing, customer acquisition & retention, B2B, C2C and B2C models of e-commerce, first mover advantage, Ecommerce business models and successful E-commerce companies,). Small business management/family business. Leadership & management. Basic book keeping. Nature of family business and family business growth model. Negotiation and business communication (Strategy and tactics of negotiation/bargaining. Traditional and modern business communication methods). Opportunity discovery demonstrations (business idea generation presentations, business idea contest, brainstorming sessions, idea pitching). Technological Solutions (the concept of market/customer solution, customer solution and emerging technologies. Business applications of new technologies - Artificial Intelligence (AI), Virtual/Mixed Reality (VR), Internet of Things (IoTs), Blockchain, Cloud Computing, Renewable Energy etc. Digital Business and E-Commerce Strategies).

MCB 398 Entrepreneurship for Microbiology (2 Units C: LH 30)

Learning Outcomes

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

1. identify basic concepts of entrepreneurship in Microbiology;
2. demonstrate basic business skills;
3. identify areas in Microbiology that they can develop into small scale businesses; and
4. identify areas in microbiology for self-employment.

Course Contents

Identification of the basic concepts of entrepreneurship and Business skills. Scope of various aspects of Applied Microbiology- Medical Microbiology, Public health Microbiology, Immunology, Agricultural Microbiology, Food and Dairy Microbiology, Industrial Microbiology, Microbial Ecology, Petroleum Microbiology, Microbial Genetics and Molecular Biology, Genetic Engineering, Impact Assessment, Health Safety and Environment. Students will be exposed to employment opportunities in these aspects. Students will be introduced to various self – employment opportunities in these aspects of Microbiology. Students will be assisted in designing businesses of their choice within these aspects. The designed business may be validated by a professional entrepreneur educator and a professional in the field of study that relates to the business in question so as to assess the workability of the business as a small scale business, the financial cost of the business, market outlet of the business, economic gain of the business and its sustainability. Team (5 to 7 students) work will be encouraged so as to prevent repeated business design by single individuals, reduce financial cost of setting individual businesses and strengthen the manpower capacity of the business. Success stories of business entrepreneurs would be included in the curriculum especially in the student field of study so as to motivate the student to develop interest towards self – employment and self-productivity Students with best business design would be given recognition.

MCB 305: Fungi of Medical, Food and Industrial Importance

(2 Units C: LH 30; PH 45)

Learning Outcomes

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

1. discuss the structure, physiology and classification of fungi;
2. explain pathogenicity, immunity, epidemiology, treatment and incidence of fungi of medical importance; and
3. describe physiology and metabolites of fungi used in food and industrial microbiology.

Course Contents

Structure, life cycles, physiology and classification of fungi. Fungi of medical, food and industrial Importance, fungal pathogenicity, immunity epidemiology, incidence treatment-Superficial mycoses (ringworm, superficial candidosis, pityriasis), subcutaneous mycoses (Mycetoma, Histoplasmosis, Phaeohyphomycosis). Systemic mycoses coccidomycoses, blastomycose, Paracocidio-domycosis, aspergillosis, cryptococcosis). Fungi of food and industrial importance (Aspergillus niger, Saccharomyces cerevisiae importance. Metabolites of fungi, industrial uses of fungi. Fungi in medicine.

MCB 307: Immunology **(3 Units: C LH 30; PH 45)**

Learning Outcomes

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

1. explain the basic concepts of immunology and diagnostic immunology;
2. describe the types of immunity;
3. elucidate the structure of antibodies(immunoglobulins) and antigens,
4. explain the origin of the B and T cells;
5. discuss the role of immunity in protection against diseases;
6. describe the harmful effects of immunological responses;
7. identify the types of vaccines; and
8. describe animal and human vaccine production

Course Contents

Introduction; historical background. Innate and acquired immunity. Antigens, antibodies, cellular immunity. Immunological tolerance and suppression. Surgical grafting. Complement system. Hypersensitivity. Immunological anomalies. Diagnostic immunology. Vaccines, effect or systems of parasite killing and nature of resistance in plants. Animal and human vaccine production.

MCB 309: Food Microbiology **(2 Units C: LH 30; PH 45)**

Learning Outcomes

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

1. identify the factors responsible for food spoilage and food quality enhancement;

2. state the microorganisms involved in food spoilage;
3. explain the microbial indices of food quality; methods for food quality assessment;
4. describe the international microbiological standards for food quality assessment;
5. discuss the traditional and rapid methods for estimating microbial populations in foods quality; and
6. identify novel food production processes.

Course Contents

The distribution, role and significance of micro-organisms in food. Examples of international and national fermented foods. Intrinsic and extrinsic parameters of foods that affect microbial growth. Food spoilage and food borne diseases. Microbial indices of food sanitary quality international and national microbiology standards for food quality. Diseases of animal transmittable to man via food products. Rapid methods for assessing microbiological quality of foods. Traditional and modern methods for food preservation. Ecology, taxonomy, biochemistry and analytical technology of bacteria, yeasts, fungi and viruses associated with food spoilage, food-borne diseases and fermentations. Emphasis on new developments in food microbiology. Economic consequences of micro-organisms in food. Exploitation of micro-organisms in novel processes for the production of food ingredients.

MCB 322: Bacterial Diversity (3 Units C: LH 30; PH 45)

Learning Outcomes

At the end of the course, students will be able to:
1. explain the morphology, life cycle and biochemical characteristics of bacteria; 2. discuss bacterial systematics and other prokaryotes; and
3. describe the identification and isolation of bacteria.

Course Contents

The morphology, life cycle and biochemical characteristics of bacteria. Systematic study of bacteria (autotrophic- photoautotrops, chemoautotrophs and heterotrophic-enterobacteriaceae, pseudomonadaceae, bacillaceae) and other prokaryotes (Mycoplasma, Clamydia), their nature, characteristics, habitats, identification and isolation.

MCB 324: Microbial Ecology (3 Units C: LH 30; PH 45)

Learning Outcomes

At the end of this course, students will be able to:
1. describe microbial interactions between microbial populations;
2. explain microbial interactions between plants and animals;
3. identify microbial community dynamics;
4. elucidate transfer of matter and energy between trophic levels in an ecosystem; and

5. explain biotechnological aspects of microbial ecology (metal recovery, hydrocarbon recovery, biofuel generation)

Course Contents

Microbes and ecological theory. Microbial evolution (chemical and cellular evolution) and biodiversity, phylogeny, physiological, morphological and genetic adaptations of micro-organisms to their environment. Microbial interactions (interactions among microbial populations, interaction between microorganisms and plants interactions between microorganisms and animals). Microorganisms in natural ecosystems. The life of micro-organisms in air, springs, rivers, lakes and seas. Biogeochemical cycling of elements in water, soil and sediments (including methanogenesis, methylotrophy transformations involving carbon, nitrogen, sulphur, phosphorus and manganese etc.). Microbial community dynamics (include genetic/molecular diversity indices, species diversity indices). Biotechnology aspects of microbial ecology (e.g. global warming, microbial enhanced oil recovery, liquid waste treatment, recovery of metals and biofuel generation). Aeromicrobiology.

MCB 399: Industrial Attachment II (12 Weeks) (3 Units C)

Learning Outcomes

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

1. identify the needs of industry; and
2. recognise the role of a microbiologist in an industry.

Course Contents

Students will be posted to industrial establishments such as food processing, brewing, distillery, pharmaceutical, research institutes, petroleum companies, petrochemical companies, government regulatory agencies, medical and health institutions. A report is submitted for grading.

GOU-MCB 301: Coal Microbiology and Biotechnology (2 Units; Compulsory: LH = 15; PH = 45)

Senate-Approved relevance

Coal biotechnology can be relevant to students by providing opportunities for career development, research, and innovation, while also contributing to environmental sustainability and energy security. The course aims to produce competent and knowledgeable graduates who can effectively explore the potential of biotechnology to reduce the environmental impact of coal utilization and contribute to a more sustainable energy future. This also includes transformation of coal into different viable products. The ultimate goal is in line with Godfrey Okoye University's vision to become a center of academic excellence by effectively harnessing the available resources in the environment for teaching, research, community service, and sustainable economic development. This is particularly crucial in Enugu State, which is home to the largest coal mine in Nigeria.

Overview

Coal is an indigenous resource in Enugu State, located in southeastern Nigeria. It is a fossil fuel that was formed millions of years ago from the remains of plants that lived and died in the area. Enugu State is home to the largest coal mine in Nigeria, which is located in the town of Enugu. The coal reserves in Enugu State have played a significant role in the development of the state's economy, including providing employment opportunities, growth of industries and contributing to the state's Gross Domestic Product (GDP). Enugu State's coal reserves have been used for domestic purposes, such as cooking and heating, as well as for industrial and energy production purposes.

In the past, coal was a major source of energy for electricity generation in Nigeria. However, in recent years, the country has shifted its focus to other sources of energy such as natural gas, solar, and wind energy. The coal industry in Enugu State has also faced some challenges, including environmental degradation, health hazards for miners, and the decline in the demand for coal. Despite these challenges, Enugu State's coal reserves still hold significant potential for the state's economic development. The state government is exploring ways to revive the coal industry by promoting cleaner coal technologies, exploring export opportunities, and partnering with the private sector to invest in the coal sector. The course is intended to expose to students all the benefits and opportunities of coal exploration.

Objectives

The objectives of the course are to:

1. Describe the structure of coal, its physical and chemical properties, composition and reactivity
2. Explain the various characteristics of microorganisms present in coal and how they interact with their environment and other bacteria and fungi in the environment.
3. Evaluate the environmental impact assessment (EIA) of coal conversion processes on air and water quality, soil health, and the release of greenhouse gases.
4. Describe and demonstrate the biotechnological skills, knowledge, process conditions and potential applications of coal biotechnology which includes the production of biochemical, bioplastics biofuel and selection of Plant growth-promoting bacteria (PGPB) which are used as biofertilizers).
5. Describe the various techniques (bioconversion, bioleaching, and bioprocessing) for converting coal into useful products.
6. Name and explain the challenges associated with the commercialization of coal biotechnology products.

Learning outcomes:

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

1. Describe the structure of coal and its properties including its composition, physical and chemical characteristics, and reactivity.
2. Explain the metabolism, growth, reproduction, and other characteristics of microorganisms and how they interact with their environment (bacteria and fungi) as well as their application in conversion of coal into useful products.
3. Identify the environmental implications of coal biotechnology, including the impact of coal conversion processes on air and water quality, soil health, and the release of greenhouse gases.

4. Demonstrate biotechnological skills and knowledge on the process conditions and potential applications of coal biotechnology which includes; production of biochemicals, bioplastics biofuel and selection of Plant growth-promoting bacteria (PGPB) which are used as biofertilizers).
5. Describe the various techniques for converting coal into useful products, including bioconversion, bioleaching, and bioprocessing.
6. Itemize the challenges associated with the commercialization of coal biotechnology products.

Course contents

Overview of coal biotechnology. History of coal utilization. Importance of coal in the energy industry. Types of microorganisms found in coal. Characterization of microbial communities in coal. Microbial metabolism in coal environments. Microbial interactions in coal ecosystems. Bioconversion of Coal to Fuels and Chemicals (Bioconversion of coal to methane. Bioconversion of coal to liquid fuels). Microbial production of chemicals from coal. Challenges and opportunities in coal bioconversion. Overview of coal contamination. Microbial remediation of coal-contaminated Air, water and soil (pollution). Phytoremediation of coal-contaminated sites. Integrated approaches for bioremediation of coal-contaminated sites. Biotechnology for Coal Mining and Processing (Microbial leaching of minerals from coal. Microbial desulfurization of coal). Environmental impact assessment (EIA). Microbial groups in surface and subsurface coal environments; coal mine areas, drainages, spoil heaps, and coal beds. Techniques for estimation of microbial populations in water, air and soil (Membrane filtration and multiple tube fermentation techniques). Case Studies in Coal Biotechnology (Biotechnology for coal mining and processing). Current research trends in coal biotechnology, Potential future developments in coal biotechnology.

Minimum academic Standards requirements and equipment: As are present in the 70% CCMAS.

GOU-MCB 312: Microbial Enzymes and Livestock Management (2 Units; Elective; LH = 15; PH = 45)

Senate approved relevance

The study of Microbial enzymes and poultry management is important In the training of microbiology graduates in line with the visions of Godfrey Okoye University, which is to be a center of academic excellence by utilizing the available resources in the environment for teaching, research, community service and sustainable economic development, because it will lead to the development of more efficient and sustainable animal feed formulations by graduates of Microbiology.

Overview

Microbial enzymes can be used to break down complex carbohydrates, proteins, and other nutrients in feed, making them more bioavailable and easier to digest for livestock. This can lead to improved feed conversion rates, higher growth rates, and better overall animal health.

The use of microbial enzymes in animal feed can help to reduce the environmental impact of livestock production, as it can reduce the amount of feed required and the amount of waste

produced. Overall, the study of microbial enzymes in livestock management can contribute to more sustainable and profitable animal production practices.

Objectives

The objectives of the course are to;

1. Identify the role of microbial enzymes and their importance in the digestion and absorption of nutrients in animals.
2. Identify microbial sources of enzymes for animal feed.
3. List and explain microbes that produce enzymes and their potential use in animal feed formulations.
4. Classify and describe properties of microbial enzymes, including their structure, function, and specificity.
5. Evaluate the efficacy of enzyme supplementation in animal feed.
6. Outline the benefits and limitations of using enzymes in animal feed.
7. List the different methods used to evaluate the efficacy of enzymes in animal feed, including feed conversion rates and animal growth performance.
8. Apply enzymes in animal feed formulation and processing.
9. Develop sustainable and efficient animal production practices on how enzymes can be used to improve animal feed efficiency, reduce waste, and promote sustainable animal production practices.

Learning outcomes

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

1. State the role of microbial enzymes in animal nutrition and their impact on animal health and growth.
2. Identify the different sources of microbial enzymes and their characteristics, including their production, purification, and properties.
3. Explain the mechanism of enzyme action and the factors that influence enzyme activity and stability.
4. Evaluate the efficacy of enzyme supplementation in animal feed and assess its impact on feed efficiency, animal performance, and health.
5. Apply different techniques for incorporating enzymes in animal feed formulations and processing, and understand the principles of enzyme application in different animal production systems.
6. Assess the economic and environmental benefits of using microbial enzymes in animal feed, and their impact on the sustainability of animal production practices.
7. Outline the regulatory and safety issues associated with enzyme use in animal feed, and the importance of adhering to guidelines and regulations.
8. Develop skills in designing and conducting experiments to evaluate the efficacy of enzyme supplementation in animal feed and analyze the data obtained.

9. Identify future research directions and opportunities in the field of microbial enzymes and livestock management, and understand the importance of continued innovation and advancement in this area.

Course outline

Introduction to microbial enzymes and their role in animal nutrition. Microbial sources of enzymes for animal feed. Classification and properties of microbial enzymes. Enzyme production and purification techniques. Enzyme kinetics and factors affecting enzyme activity. Mechanisms of enzyme action and substrate specificity. Application of enzymes in animal feed formulation and processing. Benefits and limitations of using enzymes in animal feed. Enzyme supplementation for monogastric and ruminant animals. Evaluation of enzyme efficacy and feed conversion efficiency. Effect of enzymes on animal growth performance and health. Enzymes in animal waste management and environmental sustainability. Enzyme use in specialty animal diets and applications in aquaculture. Types of Microbial Enzymes Used in Animal Feed. Overview of different types of microbial enzymes used in animal feed. Enzymes for starch digestion. Enzymes for protein digestion. Enzymes for fiber digestion. Regulatory considerations associated with enzyme use in animal feed. Safety concerns associated with enzyme use in animal feed

Minimum Academic Standards requirements and equipment

As are present in the 70% CCMAS.

GOU-MCB 323: Tropical Soil Microbiology (2 Units; Compulsory; LH = 15; PH = 45)

Senate approved relevance

The study of tropical soil microbiology is vital for training of sound graduates who are vast in knowledge on soil microorganisms, their ecosystems, soil fertility maintaince, promotion of sustainable agriculture and environmental management practices**.** This is in harmony with Godfrey Okoye University's mission to produce graduates that are not only employers of labor but also consultants to many industries and establishments.

Overview

Soil microbiology is the study of microorganisms that inhabit soil and their interactions with the soil ecosystem. Microorganisms in soil include bacteria, fungi, archaea, protozoa, algae, and viruses. These microorganisms play essential roles in soil processes such as nutrient cycling, organic matter decomposition, and soil structure formation. They also have a significant impact on the productivity and health of plants, animals, and humans that depend on the soil ecosystem.

Overall, the study of soil microbiology is crucial for understanding the complex interactions between microorganisms and the soil ecosystem, and for developing sustainable agriculture and environmental management practices.

Objectives

The course has the following objectives, to:

1. Describe the role in nutrient cycling by decomposing organic matter and making nutrients available to plants.
2. Assess soil fertility and quality.
3. Develop sustainable agricultural practices that minimize the use of synthetic fertilizers and pesticides.
4. Explain the role of microorganisms in soil health and fertility.
5. Outline the effects of climate change on tropical soil microorganisms.
6. Develop bioremediation techniques that harness the power of microorganisms to clean up contaminated soil.
7. Explain diversity and interactions of microorganisms in natural environments to gain insights into the complex relationships between microorganisms and their environment.

Learning outcomes

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

1. Describe the vast array of microorganisms that exist in soil, which includes bacteria, fungi, protozoa, and other microorganisms that play critical roles in nutrient cycling, decomposition, and other soil processes.
2. State role of microorganisms in maintaining soil fertility which includes the conversion of organic matter into plant-available nutrients, the fixation of nitrogen, and the suppression of plant pathogens.

3. Explain how different soil management practices affect the diversity and activity of microbial communities.
4. State the role of microorganisms in carbon sequestration.
5. Explain the interactions between microorganisms and plants
6. Explain the role of microorganisms in bioremediation, or the use of microorganisms to degrade pollutants and contaminants in soil.

Course outline

Introduction to tropical soils and their microbiology. Nature of soil components, texture, profile and soil as a microbial environment. Quantitative determination of soil microorganisms and their ecology. Decomposition of organic matter and carbon cycling in tropical soils. Nitrogen cycle. Bacterial fertilizers. Transformation of phosphorus, Sulphur, iron, pesticides, hydrocarbons etc. Microbial formation of petroleum. Plant root/soil microbe's inter-relationship - rhizosphere, mycorrhizae and root pathogens. Soil fertility and nutrient cycling in tropical soils. Microbial technologies for sustainable agriculture in the tropics. Human impacts on tropical soil microbial communities. Future directions in tropical soil microbiology; emerging research topics and techniques in tropical soil microbiology, applications of microbial technologies for sustainable development in the tropics. Bioremediation and biodegradation of pollutants in tropical soils. Role of microorganisms in nutrient acquisition and cycling. Implications for sustainable agriculture and restoration of degraded soils. Opportunities and challenges for research and education in tropical soil microbiology.

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Minimum academic Standards requirements and equipment

As are present in the 70% CCMAS.

GOU-MCB 334: Diagnostic Microbiology (3 Units; Compulsory; LH = 30; PH = 45)

Senate approved relevance

Diagnostic microbiology is a critical field in microbiology that involves the identification of microorganisms that cause infections and diseases. The overall relevance of diagnostic microbiology lies in its ability to provide accurate and timely diagnosis of infectious diseases, which is crucial for patient management and the prevention of the spread of infectious diseases.

This is in harmony with Godfrey Okoye University's mission to produce graduates that are not only employers of labor but also consultants to many industries and establishments

Overview

Diagnostic microbiology is the study of identifying and characterizing microorganisms that can cause diseases in humans, animals, and plants. The field of diagnostic microbiology has evolved significantly over the years with the development of advanced laboratory techniques and technological innovations. Diagnostic microbiology involves the isolation and identification of microorganisms from clinical specimens such as blood, urine, sputum, and other bodily fluids, as well as environmental sources such as soil, water, and food. The identification of microorganisms is essential for determining the cause of infections and selecting appropriate treatment strategies.

Diagnostic microbiology also involves the testing of microbial susceptibility to antibiotics and other antimicrobial agents to determine the most effective treatment options. This helps to prevent the development of antibiotic resistance, a major public health concern worldwide. Furthermore, the field of diagnostic microbiology plays an important role in the surveillance of infectious diseases and outbreaks, which helps to monitor the spread of diseases and to implement preventive measures. Overall, diagnostic microbiology is an essential part of modern healthcare, providing important insights into the causes and treatment of infectious diseases.

Objectives

It has the following objectives, to:

1. Identify the specific pathogenic microorganisms causing the infection or disease.
2. Analyze the specimen to determine the presence and type of microorganisms and
3. Test the susceptibility of the pathogen to various antibiotics and antimicrobial agents which will help in selecting the appropriate treatment.
4. Quantify the number of microorganisms can also provide useful information about the severity of the infection or disease.
5. Characterize the virulence factors which can help in predicting the severity of the infection or disease and the likelihood of complications.
6. Evaluate the immune response to provide valuable information for diagnosis and treatment. And evaluate the efficacy of treatment by tracking changes in the number and type of microorganisms present in the specimen over time.

Learning outcomes

On completion of this course, the student will be able to;

1. Identify common microbial pathogens including bacteria, viruses, fungi, and parasites.
2. Distinguish between different types of pathogens based on their morphology, growth characteristics, and biochemical properties.
3. Apply staining techniques, culture and sensitivity testing, serological tests, and molecular assays. to interpreting results, and using the results to make a diagnosis.
4. Explain the principles of antimicrobial therapy, including the mechanisms of action of different antimicrobial agents, their pharmacokinetics, and their potential side effects.

5. Interpret laboratory results of different types of microbial growth patterns, serological results, and molecular assay results.
6. Explain the principles of infection control, including the use of personal protective equipment, proper hand hygiene, and the proper disposal of infectious waste.

Course outline

Direct examination of clinical specimen for parasites, WBC, RBC, etc. Principles and techniques of the common staining methods in microbiology. Types of media preparation and uses. Isolation of microorganisms from clinical specimen. Identification of isolates and antibiotic susceptibility testing including preparation of sensitivity disc. Microbial physiology. Microbial genetics. Bacterial structure and identification. Antibacterial agents. Immunology; innate and adaptive immune responses. Serology diagnosis. Serological testing methods such as agglutinations, complement fixation etc. Molecular diagnostics. Virology. Clinical microbiology. Quality control in microbiology. Public health microbiology. Mycology.

Minimum academic Standards requirements and equipment

As are contained in the 70% CCMAS.

GOU-MCB 335: Aquatic Microbiology (2 Units; Compulsory; LH = 15; PH = 45)

Senate approved relevance

Aquatic microbiology lies in its contributions to understanding the crucial roles of microorganisms in aquatic ecosystems, as well as its practical applications in various industries. This study is in accordance with the vision of Godfrey Okoye University as a center of academic excellence by utilizing the available resources in the environment for teaching, research, community service and sustainable economic development. In Enugu State, aquatic microbiology is highly relevant due to the state's abundance of water resources, including rivers, lakes, and ponds. The microbiology of these aquatic ecosystems is important to understand because it can have significant impacts on human health, the environment, and the economy.

Overview

Aquatic microbiology is the study of microorganisms that live in aquatic environments, including oceans, rivers, lakes, and wetlands. This field of study is of great importance because aquatic microorganisms play a vital role in the ecology of aquatic ecosystems, affecting water quality, nutrient cycling, and the overall functioning of the ecosystem. Aquatic microbiology encompasses a broad range of topics, including the diversity of aquatic microorganisms, their physiological and ecological roles, and their interactions with other organisms in the aquatic environment. The study of aquatic microbiology also involves the investigation of the impact of anthropogenic activities on aquatic microorganisms, such as pollution, climate change, and overfishing.

Aquatic microbiology is a rapidly evolving field, and advances in molecular biology and analytical techniques have greatly expanded our understanding of the diversity and function of aquatic microorganisms. Research in aquatic microbiology has led to the discovery of novel microorganisms with unique metabolic pathways, and the development of biotechnological applications for the use of aquatic microorganisms in environmental remediation, bioremediation, and biotechnology. The study of aquatic microbiology is essential for the sustainable management of aquatic ecosystems and the development of innovative solutions for environmental challenges facing our planet.

Objectives

The objectives of this course are to:

1. Explain the microbial processes in aquatic environments and the role they play in the biogeochemical processes of these environments. This includes the cycling of nutrients, carbon, and energy, as well as the degradation of pollutants.
2. Identify harmful microorganisms that can cause waterborne diseases or harmful algal blooms.
3. Discuss new technologies for water treatment, such as bio filtration, and biodegradation which can help to remove pollutants and improve the quality of water for human consumption and other uses.
4. Describe the effects of climate change on aquatic ecosystems
5. Identify the ecological roles of microorganisms in aquatic environments and develop strategies for their conservation and management.

6. List the factors and adaptive mechanisms that affect the presence of microorganisms in fresh and marine water environment.

Learning Outcomes

Upon successful completion of this course, the student will be able to:

1. Define aquatic microbiology and identify important topics in the field
2. Explain the scientific principles and foundations of aquatic microbiology
3. Identify the complex roles that microbes play in marine, freshwater, global, and human systems
4. Analyze primary and secondary literature on microbiology
5. Analyze and evaluate the validity and flaws of scientific data from different sources
6. Explain the importance of microbial metabolism and diversity in ecosystem functioning and health
7. Compare and Contrast the processes that microbial communities perform in different habitats
8. Identify concepts and questions in aquatic microbiology.

Course outline

Survey of microorganisms in oceans, estuaries, lakes, ponds, rivers and springs. Chemical and physical properties of aquatic environment. Predominant organisms in aerobic and anaerobic area of aquatic environment. Water treatment. Water supply and public health. Conventional and advanced water treatment in hot climates and the use of waste water in agricultural irrigation. Fish culture. Industry and for municipal purpose. Sewage and sewage disposal in hot climates. Microbial aspect of water management. Eutrophication and bioremediation. Evolution. Ecology and diversity of marine environment. Origin of life in the sea and the evolutionary patterns suggested by the marine fossils beds. Major marine environment such as coral reefs, the deep sea floor, hydrothermal vents, the open ocean and rotated zones. Diversity of plants and animals in each environment and the adaptations they have to vastly different conditions.

Minimum Academic Standards requirements and equipment

As are present in the 70% CCMAS.

GOU-MCB 346: Basic Forensic Microbiology and Metagenomics (2 Units; Compulsory; LH = 15; PH = 45)

Senate approved relevance

The study of Forensic Microbiology and Metagenomics has important applications in law enforcement, public health, biodefense, and archaeology. It allows for the identification of microorganisms in a variety of contexts, providing insights into criminal investigations, infectious disease outbreaks, and historical events. In line with Godfrey Okoye University's mission to produce graduates that are not only employers of labor but also consultants to many business organizations, the performance of graduate students who have studied Forensic Microbiology and Metagenomics is expected to be strong, as they have received specialized training in a highly relevant and in-demand field.

Overview

Basic Forensic Microbiology and Metagenomics is a branch of forensic science that involves the analysis of microorganisms to provide evidence for investigations. Microorganisms, including bacteria, viruses, and fungi, can play a role in criminal investigations, foodborne illness outbreaks, and environmental contamination incidents. Metagenomics is a technique used to analyze microbial communities and their genetic material in various samples.

The study of Basic Forensic Microbiology requires specialized training and expertise in microbiology, molecular biology, and forensic science techniques.

Objectives

It has the following objectives, to:

1. Describe the scope of forensic microbiology and metagenomics
2. Identify and characterize microbial populations in various environments
3. Identify specific pathogens or toxins that may have caused death.
4. Identify the origin of a disease outbreak and preventing future outbreaks.
5. Analyze samples from the scene of an incident, by identifying the source of the biological agent used and potentially identify the perpetrators.
6. Compare microbes between individuals and their environments by analyzing the microbiome of an individual
7. Demonstrate how to investigate crime scenes and analyze samples.

Learning Outcomes

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

1. Define and explain the scope of forensic microbiology bioterrorism, agro-terrorism and biological warfare.
2. Define and explain the scope of bioterrorism, agro-terrorism and biological warfare.
3. Analyze types of samples, sample collection techniques and sample matrix for forensic microbiology purposes.
4. Describe the techniques used in identifying causative biological agents of bioterrorism, agro-terrorism and biological warfare.
5. Explain the applications of forensic microbiology.
6. Investigate a crime scene and analyze samples.

Course Contents

Definition and scope of forensic microbiology. Forensic science techniques. Bioterrorism, agro-terrorism and biological warfare. Types of samples collected. Sample collection. Sample matrix analysis. Water sample analysis. DNA profiling. Techniques used in elucidating causative biological agents. Investigating a suspected bioterrorist attack. Postmortem microbiology (PMM) analysis. Applications of forensic microbiology. Metagenomics. Microbial Forensics in Criminal Investigations. Biothreat Agents. Environmental Forensics. Microbial Forensics in Agriculture. Forensic Entomology. Career Opportunities in Forensic Microbiology.

Minimum academic Standards requirements and equipment

As are present in the 70% CCMAS.

MCB 405: Principles of Epidemiology & Public Health Microbiology
(2 Units C: LH 30)

Learning Outcomes

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

1. explain epidemiological concepts (distribution, frequency, determinants, population, pattern) indices;
2. explain herd immunity and its importance;
3. describe epidemiological field investigation methodologies;
4. illustrate mode of viral replication, episomes, virallatency(episomal latency and proviral latency); immunization, transmission of diseases by direct and indirect methods; and 5. explain schedules and zoonotic infections

Course Contents

Epidemiology and epidemiological concepts and types of epidemiology. Statistical applications to epidemiology. Nature of epidemiological investigations. Spectrum of infections. Herd immunity. Latency of infections. Multifactorial systems in epidemics. Zoonoses. Antigenic drifts. Biological products for immunization. Schedules for international control of infectious diseases. Transmission routes and infectious doses (airborne, waterborne, urogenital transmissions, arthropod borne, direct contact). Controlling epidemics (reducing or eliminating reservoirs, breaking transmission routes, reducing number of susceptible individuals, quarantine). Epidemiological investigations and surveillance. Disease surveillance. Emergency preparedness and global early warning System.

MCB 407: Pathogenic Microbiology (3 Units C: LH 45)

Learning Outcomes

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

1. describe the pathogenesis (virulence factors) of common bacterial and viral pathogens; epidemiology;
2. explain mode of infections; and
3. describe laboratory diagnosis and treatment of specific bacterial and viral pathogens.

Course Contents

Study of some bacterial and viral pathogens of plants, animals and man with emphasis on those prevalent in Nigeria. The geographical distribution, isolation, identification, morphology, life cycle, source of infection, transmission and the host. Ecology and clinical manifestations and treatment of specific bacterial, viral and fungal pathogens of man.

MCB 412: Microbial Genetics (3 Units C: LH 45)

Learning Outcomes

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

1. describe mutations and mutagens;
2. explain DNA transfer in bacteria, fungi and viruses;
3. describe Plasmids, Phages, Cosmids; and
4. list procedure for the transfer of the gene in Recombinant DNA Technology and procedures for recognition of transformed cell

Course Contents

Principles of genetic analysis; plasmids (conjugative and non-conjugative plasmids). Plasmid nomenclature, and transposable genetic elements, mutagenesis and DNA repairs, bacteriophages genetics and genetics of nitrogen fixation. Mechanism and nature of mutation, induction, isolation and characterization of mutants and mutagens. Genetic recombination in prokaryotes including transformation, transduction, conjugation, proptoplast fusion, site directed mutation, genetic engineering (recombinant DNA technology), DNA splicing, Restriction endonucleases and methylases DNA ligases, their nomenclature phage conversion (cosmids) and transfection. Recent techniques in microbial genetics. Chemical coding and expression of genetic information. Fungal genetics. Principles and applications of genetic engineering.

MCB 423: Industrial Microbiology (3 Units C: LH 30; PH 45)

Learning Outcomes

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

1. explain the scope of industrial microbiology and biotechnology;
2. identify industrial media composition, preparation and sources, commonly used microorganisms in industrial microbiology;
3. describe primary and secondary metabolites production and gene regulation;
4. identify sources and methods of strain improvements;
5. describe culture collection centers and preservation methods; and
6. explain fermentor design and operation

Course Contents

Microorganisms used in industrial microbiology. Screening for productive strains. Strain improvement. Fermentation systems. Design and use of fermenters. Micro-organisms of industrial importance. Patent and intellectual property rights. Classification of microbial products by use. Relationship between primary and secondary metabolism. Characteristics, sources and strain improvement of industrial micro-organisms. Microbial preservation of industrial organisms. Culture collections. Microbial growth and product formation in industrial processes. Media for industrial fermentations. Foaming, Major products of Industrial Microbiology. Enzyme production and immobilization. Production of vitamins, amino acids, antibiotics, organic acids, beer and wine.

MCB 424: Microbial Physiology & Metabolism (3 Units C: LH 45)

Learning Outcomes

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

1. explain the growth dynamics of bacterial cultures;
2. discuss the effect of physical and chemical factors affecting bacterial growth;
3. identify energy and carbon sources for autotrophic and heterotrophic bacteria;
4. describe metabolic pathways for biosynthesis of industrial microbiology;
5. elucidate anabolic and catabolic reactions,
6. explain gibbs free energy, entropy, enthalpy and their relationships; and
7. discuss energy of catabolic reactions and anabolic reactions and enzymes and activation energy.

Course Contents

Review of bacterial anatomy and cytochemistry. Dynamics of growth (batch and continuous culture). Nutrition and energy metabolism of micro-organisms. Effect of physical and chemical factors on growth; biochemistry of various microbial processes such as transport, regulation and respiration. Biosynthesis of microbial products. Bioenergetics, autotrophic (photoautotrophs and chemoautotrophs) metabolism, catabolism and anabolic reactions, activation energy and Enzyme action and control Buffer preparation and standardization. Basic separation techniques in microbiology, dialysis, salting out, gel filtration, electrophoresis etc. Assay techniques for various metabolites including microbial enzymes, acids etc.

MCB 425: Environmental Microbiology (3 Units C: LH 30; PH 45)

Learning Outcomes

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

1. explain the various definitions of environmental pollution;
2. identify types of environmental pollution;
3. discuss inorganic, organic and biological indices of pollution;
4. identify regulatory agencies involved in Pollution monitoring in Nigeria;
5. discuss the impact of urbanization on pollution;
6. explain impact assessment (Environmental Impact Assessment, Environmental Evaluation Studies, Post Impact Assessment) and Microbiological aspects of impact assessment;
7. elucidate bioaccumulation (bioconcentration, biomagnification and depuration)
8. identify methods of sewage treatment;
9. explain membrane filtration and Multiple tube fermentation methods for estimating bacterial populations in water; and
10. describe biochemical and Chemical Oxygen Demand, Waterborne diseases and transmission, Total and Faecal Coliforms.

Course Contents

Impact Assessment (IA) of microbial contamination of soil, surface water, ground water and air in relation to the deterioration of the environment. Legal frame work for impact assessment; environmental impact assessment (EIA); post impact assessment (PIA); environmental evaluation studies(EES). Environmental audits, environmental compliance monitoring reports; soil, air and water pollution. Organic, inorganic pollutants in the environment; microbiology of aquatic, terrestrial environments. Carbon trading; acute toxicity testing, bioaccumulation (bioconcentration and biomagnification). Waste disposal (physical, chemical and biological methods) and management (cradle to grave). Microbial indicators for inorganic and organic pollution in water, methods of water and sewage treatment with emphasis on specific microorganisms involved. Techniques for estimation of microbial populations in water (Membrane filtration and multiple tube fermentation techniques). Total and faecal coliform; disease transmission by water. Biochemical and chemical oxygen demand

MCB 431: Petroleum Microbiology (2 Units C: LH 30)

Learning Outcomes

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

1. identify petroleum biogenesis and chemical composition;
2. discuss upstream, midstream and downstream activities in the petroleum industry in Nigeria; 3. explain management of wastes from activities in the petroleum industry;
4. describe petroleum prospecting and recovery of hydrocarbon fluids; microbial oil recovery procedures; microbial influenced corrosion of surface and subsurface assets and control;
5. elucidate reservoir souring, Sulphate Reducing Bacteria and Seawater reinjection challenges; and

6. explain oil spill countermeasures, chemical surfactants and biosurfactants.

Course Contents

Definition of petroleum, types of petroleum and origin of petroleum. Geological formations (types of reservoirs). Exploration and production activities (upstream, mid-stream and downstream activities). Surface assets, subsurface assets, offshore and onshore operations. Drilling wastes, production wastes, management of these wastes. Sanitary water, hydrotest water, Produced water, formation water, Injection water, drilling fluids chemical composition, drill cuttings (top hole and bottom hole). Environmental considerations in the discharge of wastes onshore and offshore, cutting reinjection technology and thermo desorption units (TDU). Biogenesis of fossil fuels with emphasis on the role of micro-organisms. Petroleum prospecting; primary recovery. Secondary recovery and tertiary recovery. Microbial corrosion of pipes and equipment. Methanogenesis and methanotrophy. Effects of oil spill on microbial activities in aquatic and terrestrial ecosystems. Biodeterioration and biotransformation of hydrocarbons. Biodegradation of organics. Factors affecting persistence/recalcitrance of organics. Biodegradability testing, bioremediation strategies (In-situ and ex-situ techniques, biostimulation and bioaugumentation) reservoir souring, sulphate reducing bacteria, seawater reinjection challenges. Bacterial desulfurisation and denitrogenisation of crude oil, oil spill countermeasures, surfactants and biosurfactants. Emusification and demulsification.

MCB 482: Virology & Tissue Culture (2 Units C: LH 30)

Learning Outcomes

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

1. identify virus classification;
2. describe replication and cytopathic effects;
3. discuss isolation, cultivation, purification and assay of viruses;
4. explain culture of viruses in egg yolk, egg white, chicken embryo, monoclonal antibodies;

and 5. describe maintenance of plant and animal cells in-vivo

Course Contents

Structure, properties and classification of viruses. Principles of isolation, cultivation and maintenance of plant and animal cells in vivo. Application of cell culture technique in virology; viruses as agents of diseases in animals.General characteristics of plant, animal and bacterial viruses. Viral replication, spread and cytopathic effects. Virus classification, purification and assay.
Regulation of lytic development and maintenance of the lysogenic state in bacteriophages lambda, P2 and 14 single stranded DNA and RNA phageviroids as pathogens.

MCB 491: Research Project (6 Units C: PH 270)

Learning Outcomes

Students will be able to

1. carryout independent research;
2. review relevant literature;
3. arrange data in a scientific manner;
4. make scientific presentations; and
5. identify methods of citing and acknowledging appropriate sources of literature.

Course Contents

A research project to be undertaken on any area of microbiological and/or biotechnological interest. The project should be such that students could complete it (production of final report) within a period of not more than five months.

GOU-MCB 402: Seminar on Current Topics In Microbiology (2 Units; Compulsory; LH = 30)

Senate approved relevance

In synchronization with the visions of Godfrey Okoye University as a center of academic excellence by utilizing the available resources in the environment for teaching, research, community service and sustainable economic development, graduates of microbiology should be able to demonstrate deep knowledge and understanding of a topic in Microbiology and display good presentation skills with clear exhibition of communication prowess, good appearance and mastery of the subject matter.

Overview

Current topics in microbiology is a course that explores the latest advancement and emerging trends in the field of microbiology. The course covers a wide range of topics including Microbial Diversity and Evolution, microbial Pathogenesis, Microbial Communities and Interactions, microbial Biotechnology, Microbial Physiology and Metabolism, Microbial Genomics and Bioinformatics, Microbial Ecology and Climate Change, Microbial Bioremediation and Environmental Microbiology. Microbial Systems Biology and microbial Evolution. Students will learn the underlining principles behind new and emerging technologies, as well as their potential applications in different industries.

The course covers all ethical, legal and societal implications of current microbiological and biotechnological systems and processes, which is rapidly growing and evolving fields of microbiology. It helps students stay informed about the current trends and learn how to avoid plagiarism when reporting from already published works.

Objectives

It has the following objectives; to:

1. Discuss ideas on recent advances in microbiology.
2. Explain the application of critical thinking and analytical skills in microbiology.
3. Evaluate scientific communication and presentation skills of students.
4. Access collaboration and networking in microbiology.

5. Analyze new skills, techniques, and best practices that can help to improve research, teaching, or microbiology work.

Learning Outcomes

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

1. Conduct a review of the literature on essay topics in Microbiology.
2. Explain the assigned essay topic.
3. Describe referencing styles appropriately and cite materials used in such reviews while avoiding the errors of plagiarism.
4. Make a short presentation to staff and students.
5. Access collaboration and networking in microbiology.
6. Analyze new skills, techniques, and best practices that can help improve research, teaching, or microbiology work.

Course outline

Overview of current trends and themes in microbiology. Importance of staying up-to-date with current research in microbiology. Strategies for critically evaluating scientific literature. Microbial Diversity and Evolution. Microbial Pathogenesis. Microbial Communities and Interactions. Microbial Biotechnology. Microbial Physiology and Metabolism. Microbial Genomics and Bioinformatics. Microbial Ecology and Climate Change. Microbial Bioremediation and Environmental Microbiology. Microbial Systems Biology. Microbial Evolution and Speciation. Microbial Control and Biodefense. Microbial Communication and Quorum Sensing. Microbial Education and Outreach. Microbial Ethics and Policy. Current Controversies in Microbiology. Debates and controversies in microbiology research and practice

Minimum Academic Standard:

As are present in the 70% CCMAS.

GOU-MCB 413: Analytical Microbiology and Quality Control (2 Units; Compulsory; LH = 30; PH = 45)

Senate approved relevance

Analytical Microbiology and Quality Control will train graduates who have acquired knowledge and skills in the identification, enumeration, and characterization of microorganisms, as well as the evaluation of the quality of products and processes in various industries. This is in line with the visions of Godfrey Okoye University's mission to produce graduates that are not only employers of labour but also consultants to many business organizations

Overview

Analytical microbiology is the branch of microbiology that deals with the study and identification of microorganisms present in different samples, such as food, water, soil, and air. The aim of analytical microbiology is to detect, identify, and quantify microorganisms present in these samples and to assess their potential impact on human health, the environment, and the economy. Quality control is an essential component of analytical microbiology that ensures that the results obtained from microbiological analyses are accurate and reliable. Quality control measures are designed to ensure that the analytical methods used are validated, the instruments and equipment are calibrated and maintained properly, and the personnel performing the analyses are trained and competent. In analytical microbiology, there are different methods for the detection and identification of microorganisms. These methods can be classified into traditional or conventional methods and modern or rapid methods.

In summary, analytical microbiology and quality control are essential components of microbiology that ensure the accurate and reliable detection and identification of microorganisms present in different samples. The use of modern techniques and quality control measures has improved the accuracy and reliability of microbiological analyses, which has important implications for human health, the environment, and the economy.

Objectives

It will have the following objectives, to:

1. Identify pathogenic microorganisms in food, water, and other environmental samples, in order to ensure public health and safety.
2. Identify microbial populations in environmental samples, such as soil and water, to understand ecosystem dynamics and identify potential environmental hazards.
3. Characterize microbial populations in environmental samples, such as soil and water, to understand ecosystem dynamics and identify potential environmental hazards.
4. Assess the effectiveness of microbiological control measures, such as sanitation procedures and antimicrobial treatments, in order to ensure the safety and quality of food and other products.
5. Identify microbial contaminants in industrial processes and products, such as pharmaceuticals and cosmetics, in order to ensure their quality and safety.
6. Discuss new analytical methods for the detection and identification of microorganisms, in order to improve the accuracy and speed of microbiological analyses.
7. Experiment of different environments and the interactions between microorganisms and the surroundings.

Learning outcomes

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

1. Outline the principles and techniques of analytical microbiology, including the use of different culturing and isolation methods, staining techniques, and microscopy.
2. Apply analytical microbiology techniques to identify and characterize microbial strains, including their morphological, physiological, and biochemical properties.
3. Explain concept of microbial growth and be able to evaluate the growth characteristics of different microorganisms in different conditions.
4. Apply analytical methods skills to solve real-world problems related to microbial contamination and quality control in different industries.
5. Explain the principles and techniques of quality control and quality assurance, including statistical methods and process control.
6. List effective quality control protocols, including the use of microbial testing and monitoring to ensure product safety and quality.
7. Apply relevant regulations and standards in the field of microbiology and quality control.

Course outline

Micro-organism as reagents in qualitative analysis. Selection of test organisms for assays. Antibiotics. Amino acids. Vitamins. Response of test organisms. Concept of microbial growth. Morphological, physiological and biochemical properties of microbes Responses of microorganisms used in essays. Obtaining responses. Measuring responses. Preparation of assay samples. Methods of assays. Interpretation of results. Aspects of quality control. Plant and equipment sanitation. Microbiology standards. Microbiology specifications. Water quality. Effective quality control protocols.

Minimum Academic Standard

As are contained in the 70 % CCMAS.

GOU- MCB 424: Pharmaceutical Microbiology (3 Units; Compulsory; LH = 30; PH = 45)

Senate approved relevance

In line with Godfrey Okoye University's mission to produce graduates that are not only employers of labour but also consultants to many business organizations, a graduate of pharmaceutical microbiology will be trained to have knowledge and skills in the study of microorganisms that affect the production and development of drugs and other pharmaceutical products and to apply this knowledge to ensure that drugs and pharmaceutical products are safe for use by humans.

Overview

Pharmaceutical microbiology is a specialized field of microbiology that focuses on the study of microorganisms that are directly or indirectly involved in the production, development, and quality control of pharmaceutical products. It encompasses various aspects of microbiology, including microbial ecology, microbial genetics, microbial physiology, and microbial pathogenesis. The study of pharmaceutical microbiology involves the identification and characterization of microorganisms that can contaminate pharmaceutical products, as well as the development of strategies for their control and prevention. This includes the assessment of microbial growth and survival in pharmaceutical products, the evaluation of the effectiveness of antimicrobial agents, and the development of microbiological tests and methods for the detection of microbial contamination.

Pharmaceutical microbiologists are also involved in the development of sterile manufacturing processes, as well as the design and validation of cleanroom environments and equipment used in pharmaceutical production. They work to ensure that the manufacturing process is free of microbial contamination, which is essential for maintaining the safety and efficacy of pharmaceutical products. Overall, the study of pharmaceutical microbiology plays a critical role in ensuring the safety and quality of pharmaceutical products, and is essential for protecting public health.

Objectives

It will have the following objectives, to:

1. Explain the principles of microbial growth and how it applies to the production and testing of pharmaceutical products.
2. Analyze the different types of microorganisms that can contaminate pharmaceutical products and evaluate their impact on product quality.
3. Apply appropriate methods for microbial identification, enumeration, and control in pharmaceutical production environments.
4. Explain the efficacy of antimicrobial agents and their mechanisms of action in pharmaceutical products.
5. Evaluate the effectiveness of different microbial control strategies, such as sterilization and disinfection, in ensuring product quality.
6. Explain the regulations and guidelines related to pharmaceutical microbiology, such as those established by the FDA and other regulatory agencies.
7. Apply scientific principles and critical thinking skills to solve problems related to microbial contamination and product quality in the pharmaceutical industry.

Learning outcomes

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

1. Explain the structure and function of microorganisms such as bacteria, viruses, fungi, and protozoa.
2. Identify different microorganisms and state their properties, and their role in infectious diseases.
3. Describe the various factors that influence microbial growth and survival, such as temperature, pH, oxygen, and nutrients.
4. Explain the different methods of microbial control, including physical, chemical, and biological approaches.
5. Identify and analyze different types of antimicrobial agents including antibiotics, antifungals, antivirals, and disinfectants.
6. Evaluate the efficacy and safety of different antimicrobial agents and their mechanisms of resistance.
7. Enumerate and identify test results
8. Explain regulations and guidelines governing pharmaceutical microbiology, including Good Manufacturing Practice (GMP), Good Laboratory Practice (GLP), and International Organization for Standardization (ISO) guidelines.
9. Apply microbiological principles to the development and manufacture of pharmaceutical products

Course outline

Introduction to Pharmaceutical Microbiology. Principles of Pharmaceutical Microbiology. The chemistry of chemotherapeutic agents. Synthesis of chemotherapeutic agents. Antibiotics production. Synthesis of antibiotics. Synthesis of antimicrobial agents. Quality control of pharmaceutical products. List of Different microorganisms. Properties of microorganisms. Concepts of growth and death in microorganisms. The mode of action and assay of antimicrobial agents. Concepts of antibiotic sensitivity and resistance. Drugs and microbial physiology. Good laboratory practice. Microbiological principles to the development and manufacture of pharmaceutical products.

Minimum Academic Standards requirements and equipment

As are contained in the 70% CCMAS.

Minimum Academic Standards

Staffing

Academic Staff

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

Administrative Support Staff

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

Technical Support Personnel

The services of technical support staff, which are indispensable in the proper running of laboratories and workshops, are required. It is important to recruit very competent senior technical staff to maintain teaching and research equipment. They are also to undergo regular training to keep them abreast of developments in equipment operation and maintenance. In addition, there should be supporting office staff: secretary, typist, higher executive officer and messenger.

Library

(a)Library and information resources

Universities should leverage on available technology to put in place rich databases and other electronic/digital library and information resources. In addition, well stock and current hardcopies of reference and other textual materials should be provided centrally at the level of the faculty. A well network digital library should serve the entire university community. Availability of wireless facilities (Wi-Fi) with adequate bandwidth should enhance access to these electronic resources. In any case, there should be internet ready workstations available in the library for least 25% of the total student enrolled in each academic programme. The funding of the library should be in line with NUC guidelines.

There should be a Departmental Library that can contain a minimum of 50 students and equipped with relevant books, journal articles and other relevant news articles particularly on Marine Science.

Classroom, Laboratories, Clinics, Workshops and Offices Spaces

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

Laboratory Resources

Adequate space should be provided for all departments in the sciences. Effort must be made to provide each department with at least:

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

Equipment

1	Computers
2	Microscopes(Simple, Compound and Dissecting)
3	Autoclaves of various capacities
4	Incubators of various sizes
5	Centrifuges of various capacities
6	Refrigerated Centrifuge
7	Ultracentrifuge
8	Weighing balance (Electronic Top-pan balance, Double-pan Analytical Balance and Analytical Balance) of various capacities
9	Desiccators
10	Water baths including Shaking water bath
11	Shakers
12	Anaerobic jars
13	Electronic Colony Counter
14	Electronic Cell Counter
15	Magnetic Stirrer
16	Sonicator
17	Quebec Colony Counter
18	Automated Bacterial Identification Systems
19	Refrigerators of various capacities
20	Deep freezers of various capacities
21	Electric ovens (Dry oven)
22	Gas cookers with ovens (Hot air ovens) with Gas cylinders
23	Laminar Flow Chamber
24	Distilled water plant
25	Ultra-water Purification System
26	Homogeniser(Blenders) of various capacities
27	Vortex Mixer
28	Hot Plate
29	Work benches
30	Fire extinguishers
31	pH meters (digital and non-digital)

32	Total Dissolved Solids (TDS), Electrical Conductivity, Salinity meters
33	Ultra-Violets Spectrophotometers
34	Infra- red spectrophotometers
35	Turbidometers
36	Polymerase Chain Reaction Thermocycler
37	Gas Chromatograph
38	High Performance Liquid Chromatography
39	Thin Layer Chromatography
40	Paper Chromatography
41	Column Chromatography
42	Electrophoresis Unit
43	Glassware (beakers, measuring Cylinders, pipettes, Petri dishes, Syringes etc.)
44	Membrane Filtration Units
45	Air Quality Meters
46	Biochemical Oxygen Demand Incubator
47	Microtox Analyser
48	Aquaria of different sizes
49	Hemocytometer