

COURSE OUTLINE FOR UNDERGRADUATE STUDIES

Biochemistry Department

MTH 101: ELEMENTARY MATHEMATICS I

Number systems, Indices, Surds and Logarithms, Polynomials, Remainder and factor theorem, Polynomial equations, Partial fractions, Field, Ordered fields. Inequalities. Mathematical induction. Permutations and combinations. Binomial theorem. Sequences and series. The quadratic equation and function. Relation between the roots and the coefficients. Complex numbers. Addition, subtraction, multiplication and division. Argand diagram. De-Moivre theorem, n-th roots of complex numbers. Elementary set theory. Venn diagrams and application of De-Morgan's laws. Trigonometry. Elementary properties of basic trigonometric functions. Addition formulae and basic identities. Sine and cosine formulae. Half angle formulae. Area of a triangle. Solution of trigonometric equations. Inverse trigonometric functions. Functions. Concept and notation. Examples composition, Exponential and logarithmic functions. Graphs and properties. Limits and continuity. Techniques for finding limits. The derivative. Calculations from first principles, Techniques of differentiation. Chain rule. Higher order derivatives. Extreme problems. Mean value theorem. Applications. Indeterminate forms and L'Hopital's rule. Taylor's and Maclaurin's series. Curve sketching. Integration as the inverse of differentiation, as area, as limit of finite sums. Applications. ***Pre-requisite: Credits at WASC/GCE/O/L Biology.***

CHM 101: GENERAL CHEMISTRY I

Chemical reaction, equations and stoichiometry, Atomic structure and the periodic classification of elements. Electronic theory of atoms Radioactivity. Ionic and covalent bonds. Solids and their structure. Dipole interactions and its effect on physical properties. Redox reaction Equilibrium. Elementary electronchemistry. Introduction to kinetic properties of gases, Basic chemical kinetics and chemical thermodynamics, principles of metal extraction. ***Pre-requisite: Credits at WASC/GCE/O/L Chemistry.***

PHY 101: GENERAL PHYSICS I

Mechanics: space and time units and dimensions; vector; kinematics, Newton's law; Galileo invariance, statics and dynamics of particles; universal gravitation, work and potential energy, conservation of energy and momentum; rigid bodies, fluid

mechanics. Thermal properties, including elementary thermodynamics and kinetics theory. ***Pre-requisite: Credits at WASC/GCE/O/L Physics***

ENG 103: ENGINEERING DRAWING I

Introduction to engineering tools. Planning and layout of engineering drawing. Engineering drawing concept. Introduction to dimensioning of circles, holes, radii, tolerance. Descriptive geometry, freehand sketching. Introduction to drawing/drafting software and CAD basic tools. Orthographic multi view projection. Construction of plane shapes using CAD construction techniques. Presentation of data and results. Using charts, graphs, etc by appropriate computer software. Further dimensioning, addition of dimensions to drawings using CAD.

BIO 101/103: BIOLOGY FOR BIOLOGICAL SCIENCE

Cell structures and organization, plant and animal cells. Functions of cellular organelles; diversity, characteristics of living things, General reproduction, mitosis and meiosis, abnormalities associated with gene crossing, heredity and evolution. Concept of ecology and types of habitats diversity of plants and animals, food chains and food webs; interrelationship of organisms, Elementary biochemistry of carbohydrates; proteins and lipids structure and chemical characteristics. ***Pre-requisite: Credits at WASC/GCE/O/L Biology.***

ENG 101: WORKSHOP PRACTICE I

General use of engineering measuring instruments Calipers e.g. Vernier Calipers; Gauges e.g. Micrometer Screw gauge and other devices. Introduction to hand tools, Proficiency in the use of wood planer, Hand Saw, Sanders and Pattern Making. Sheet Metal Work: Production of sheet metal products – layouts, cutting, shaping, simple bend theory. Introduction to joining techniques: Soldering, brazing, fusion welding, fastening and assembly. Basic woodworking principles and tools finishing and evaluation of finished products.

GST 101: USE OF ENGLISH I

Library orientation, study aids through dictionary practice, vocabulary development techniques, reading and comprehension techniques, listening and note-taking techniques – outlining and summarizing, dealing with examination questions.

GST 103: HUMANITIES

Introduction to humanities, definition and rationale. Role literature in the humanities aspects of the contemporary African novel; significant examples of African/western poetry; dramatic art – role and relevance in modern Nigeria with practical, demonstrations/performances. Role of philosophy in the humanities, man and his quest for certainty; materialism, idealism, the meaning and significance of selected concepts – freedom, responsibility, obligation, the “good life”, art beauty; values-relative and non-relative; inductive arguments and scientific reasoning. Exposure to African History – its role and relevance, African art and music – its history and development, Religion and the meaning of life-post, present and future.

FRN 101: FRENCH LANGUAGE I

This course will introduce the students to the basics of French Language such as greeting in French, French alphabets, vowels, pronunciation and accents. The students will also learn the components of French grammar as the article, verb, etc.

IGB 101: INTRODUCTION TO IGBO GRAMMAR, COMPOSITION AND COMPREHENSION

This course will equip the students with the basic skills: listening, speaking, reading and writing in the approved 1961 orthography as the basic for standard Igbo.

BIO 102/104: BIOLOGY FOR AGRIC AND BIO. SCIENCES II (1,0,1)

Ecology: Ecosystem, biotic and abiotic factors. Interrelationship between plants and animals. Adaptations of plants and animals to their environment using local examples if possible, types of population: Dynamics, Static, Climax Community; types and factors affecting them, adaptive factors; rainfall, wind, relative humidity, light intensity, etc. modification of the natural ecosystem by Man. Agricultural microbiology: Role of microorganisms in the soil, population interactions amongst microorganisms,

pathogenic microorganisms in plants and animals. Food Microbiology: Microbes in food industries. Application of Biotechnology in Food and Agriculture.

MTH 102: ELEMENTARY MATHEMATICS II

Transcendental function. Hyperbolic functions. Inverse functions. Logarithmic differentiation. Integration by substitution, integration by part. Improper integrals. Applications. Areas and volumes. Centre of mass. Ordinary differential equations – First-order equations with variable separable. First order linear equations. Second order homogenous equations with constant coefficients. Applications. Plane analytic geometry. Rectangular Cartesian co-ordinates. Distance between two points. Straight line. Loci. The circle, parabola, ellipse and hyperbola. Second degree curves, Plane polar coordinates. Vectors: Vector addition and multiplications. Products of three or more vectors. Vector functions and their derivatives. Velocity and acceleration. Matrix algebra. Addition and multiplications. Transpose. Determinants. Inverse of non-singular matrices. Cramer's rule and application to the solution of linear equations. (Examples should be limited to $m \times n$ matrices where $M=3, N=3$). Transformations of the plane. Translation, reflection, rotation, enlargement, shear, composition of transformations. Invariant points and lines. ***Pre-requisites: Credits at WASC/GCE/O/L/Biology.***

CHM 102: GENERAL CHEMISTRY II

Organic formulae and structure. Homology and Isomerism. Concept of hybridization. Survey of reactions of functional groups in aliphatic and Aromatic compounds. Introduction to the chemistry of alkanes, Alkenes, Alkynes, Halokanes Alkanols, Esters, Amines, Aldehydes, ketones, Carboxylic acids and their derivatives. ***Pre-requisites: Credits at WASC/GCE/O/L Chemistry.***

PHY 102: GENERAL PHYSICS I

Electricity and magnetism: electrostatics; conductors and currents; dielectrics; magnetics fields and induction; Maxwell's equations; electromagnetic oscillations and waves. Geometrical optics: geometrical methods applied to the optics of mirrors, lenses and prisms.

Pre-requisite: Credits at WASC/GCE/O/LB Physics

ENG 104: ENGINEERING DRAWING II

Connections in engineering drawing. Introduction to IS code of drawing. Conics and engineering curves, ellipses, parabola, hyperbola, cycloid, trochoid,

involutes. Projection of planes and solids (cube, prism, pyramid, cylinder, cone and sphere), projection on auxiliary planes. Isometric projection. Introduction to section drawing and use of CAD construction techniques. Development and intersection of surfaces. Detail drawing with the addition of machine and surface texture symbol. Simple assembly drawing with suitable fits and part list and introduction to limits and tolerances. Screw thread, fasteners and springs including keys and key ways.

GST 102: USE OF ENGLISH II

Second stage library work with emphasis on effective search techniques, paragraph development, essay writing principles and practice, term paper writing, technical report writing, business letter writing, referencing and documentation, grammar and mechanics.

GST 108: SOCIAL SCIENCE I

This covers the nature and scope of politics and economics. From the basic concepts in economics and political science to the political set-up in Nigeria, the civil service structure, public investment and economic infrastructures to fiscal federalism and revenue allocation. A global perspective of economics; economic systems and development nations' economics, international trade and economic development; Balance of payments, commercial policies of Nigeria and other developing countries. Economic integration; state and structure of economics of ECOWAS countries, the ECA and countries, the ECA and economic co-operation in Africa. Foreign aid and investments: the multinational corporations, technological dependence. Global interdependence and the New International Economic order. World economic crises, energy and OPEC, food storages and armament.

GST 110: SCIENCE, TECHNOLOGY AND SOCIETY

The scientific evolution of man – science, need, history, classifications, and modern scientific methods; science and man's environment – Terrestrial and Cosmic Life; harnessing science – climate and vegetation. Production, processing, conservation, distribution; energy resources-solar, thermal, nuclear energy- fossil fuels, estimates of energy reserves in Nigeria.

FRN 102: FRENCH LANGUAGE II

Here, the students will be drilled in French grammar proper, dialogue and other oral exercises. The students will also be introduced into reading, starting with French Afrique Book1. At the end of the course the students should be able to speak basic French and be able to tell time in French.

IGB 102: INTRODUCTION TO IGBO HISTORY, CULTURE AND LITERATURE

This course will expose the students to various aspects of human life among the Igbos as follows: Igbo world view, Igbo culture and history, Igbo in a world of arts and civilization. It will also provide a good exposure in the area of Igbo literature which embodies the totality of the Igbo world view, including their social and cultural perspectives, their aspirations and amenities, as some contemporary texts will be incorporated in the study.

MCB 201: GENERAL MICROBIOLOGY I

Historical development of Microbiology, Milestones in the study of microbiology, Theory of spontaneous generation, germ theory of disease, contributions of Koch, Pasteur e.t.c, Scope of microbiology; sub-disciplines of microbiology. The Microbial world; Nature and general properties of Microorganisms, Microbial Kingdom; prokaryotes and eucaryotes. Tools Used in the Study of Microorganisms; Microscopes; types, advantages and limitations, factors determining the effectiveness of microscopes, magnification, resolving power, degree of contrast etc., Other basic tools and their uses, Petri-dishes, inoculation loop, autoclave, water bath, safety cabinet, centrifuge, incubator, open air oven. Microbial morphology, Cell Structure and reproduction; structure of gram negative and Gram positive bacteria, structure and function of cell wall, outer membrane, periplasm, cell membrane, pili, flagella e.t.c, shapes and arrangement of bacteria, Identification of bacteria overview; cultural characteristics, Gram staining, biochemical tests. Microbial Nutrition, Cultivation and Growth; Growth requirements and type of growth media, Nutritional categories of microorganisms, Methods of media preparation, Methods of culturing microbes; streak plate, pour plate, Pure culture techniques; serial dilution, streaking, Batch and continuous growth cultures; phases of growth in batch culture, environmental factors influencing growth; temperature, oxygen, pH, moisture, salinity, etc Antimicrobial Agents; Definition of terms; antibiotics, static and cidal agents, sterilization, disinfection, sanitization, antiseptic, Methods of controlling microorganisms, physical, chemical and radiation techniques, Major groups of disinfectants. Overview of microbial Metabolism; Definition of metabolism, Bioenergetics, Catabolism; glycolysis, TCA, PPP, Anabolism; biosynthesis of biomolecules-lipids, proteins etc, photosynthesis. **Pre-requisites:**
BIO101/104

BCH 201: CHEMISTRY OF CARBOHYDRATES & LIPIDS

Chemistry, structure and properties of carbohydrates. Classification of carbohydrates. Stereo and optical isomerism. Polysaccharide including cell-wall polysaccharides. Biological importance of carbohydrates. Tests for carbohydrates. Chemistry and classification of lipids. Lipid properties and structures. Fats, fatty acids, waxes, sterols, phospholipids, glycosphingolipids, complex lipids. Steroids and prostaglandins. Tests for Lipids.

MTH 201: MATHEMATICAL METHODS I

Functions of two or more variables. Limits and continuity, partial derivative, directional derivatives, tangent plane and normal line. Gradient, Chain rule. Total differential, implicit functions, jacobians, inverse functions. Maxima and Minima, Lagrange multipliers, Higher order derivatives, The Laplacian, Second derivative test for maxima and minima. Exact differentials. Derivatives of integrals, Taylor's theorem, Multiple integrals. Calculations of areas, volumes, centres of mass, moments of inertia and etc. Infinite sequences and series. Absolute and conditional convergence. Power series.

MTH/STA211: INTRODUCTION TO STATISTICS AND PROBABILITY

Frequency distributions, measure of location and dispersion in simple and grouped data. Laws of probability. The binomial, Poisson and normal distributions. Estimation and tests of hypothesis. Analysis of variance and co-variance, simple regression and correlation, contingency tables and χ^2 . Descriptive methods – stem and leaf charts. Graphical Displays – Box and whisker plots, Applications. **Pre-requisites: MTH 101 & MTH 102**

CSC 201: COMPUTERS AND APPLICATIONS I

Brief history of computers and computer generation. Classification of computers. Structure of a general-purpose computer. Number systems. The stored programme. Techniques of problems solving. Flowcharting. Stepwise refinement. Algorithm for searching, sorting and merging of ordered lists. Data preparation. I/O Devices. Data Types. Data Representation. Data Capture. Problem-oriented languages BASIC and FORTRAN programming: arithmetic expression, assignment statement; I/O commands; logical expression, arrays; sequencing, alternation and iteration; sub-programmes and parameters. Elementary Numerical Algorithms.

GST 201: SOCIAL SCIENCE II

Concept and meaning of development; traditional Africa's geographical and ethnographical review, family structure, kinship system, socio-economic preoccupations, political systems, art and music, modes of communication etc.; African and processes of modernization – education, writing and the press, urbanization and social change, modern trends in art and aesthetics, nationalism and cultural revival, mass media and national development.

MCB 202: GENERAL MICROBIOLOGY II

Microbial Taxonomy, Nomenclature, Classification; biological, phylo-genetics, artificial, Numerical taxonomy; principles and methodology, Type culture and culture collection, Molecular approaches to microbial taxonomy (Nucleic Acid Hybridization). Systematic Classification Of Microorganisms; Bacteria-introduction of different groups of bacteria and their basic characteristics. Economic importance of bacteria, Fungi-introduction of different classes of fungi and their basic characteristics. Types of hyphae, reproduction and spores. Economic importance of fungi. Protozoa; Introduction to different classes of protozoa and their basic characteristics, reproduction in protozoa, economic importance of protozoa. Viruses; introduction of different classes of viruses; lytic and lysogenic cycles, Economic importance of viruses. Algae; introduction of different classes of algae and their basic characteristics, reproduction and pigmentation in algae, economic importance of algae, Biogeochemical cycles; roles of microorganisms, ecological importance-carbon, nitrogen, sulfur, phosphorous, etc. Systemic identification of Microorganisms; Morphological and cultural characteristics, Physiological characteristics; biochemical tests and principles. Specific And Non-Specific Immunity; Characteristics and mechanisms, Roles of B-cells and T-cells in immunity. Microbial variation and Heredity; The basics of genetic elements, Structure of nucleic acids, storage and flow of genetic information; replication, transcription and translation, Genetic code, Transfer of genetic information; conjugation, transformation and transduction, Mutation; types and consequences; detection and isolation of mutants. Microbe-Host Interactions; Host-parasite relationships, normal flora; significance and members of different parts of the body, Roles of resident flora.

CHM 202: INORGANIC CHEMISTRY I

Chemistry of the s-p, and d-block elements. Relationship between electronic structure, size and reactions of compounds. Periodicity of the elements, illustrated by a study of their simple hydrides and halides. Solid state structures of simple AB and AB_2

compounds of the s, p and a block elements. Polymorphism. Theory and principles of qualitative and quantitative inorganic analyses. Separation of elements into analytical groups by the solubility of their compounds in qualitative inorganic analysis.

CHM 204: ORGANIC CHEMISTRY I

Aromaticity, functional group chemistry in aromatic and aliphatic compounds. Alicyclic compounds, conformation and conformational isomerism. Stereochemistry and stereoisomerism. Modes of bond formation and fission in organic compounds, electronic and steric effects. Substitution, addition and free radical reactions. Kinematics and thermodynamic and control of products. Nucleophilic and electrophilic substitution reactions. Functional groups analyses.

BCH 202: CHEMISTRY OF PROTEINS & NUCLEIC ACIDS

General properties of proteins. Classification of proteins & amino acids. Structure of proteins: Primary, secondary, tertiary and quaternary structure. Denaturation of proteins, Purines, pyrimidines, nucleosides and nucleotides. Nucleic acid structure. The RNAs and their functions. Genome organization. Nucleo-proteins. Tests for amino acids, proteins and nucleic acids. Some proteins as enzymes. Cofactors and coenzymes as requirements for enzyme activity.

BIO 202: BIOLOGICAL TECHNIQUES

Preparation of microscope slides. Biological drawings, microtomy, colorimetry, photometry, cytological techniques. Collection and preservation of Biological specimens. Conductometry. Herbarium. Technique: electrophoresis, experimental design.

MTH 222: NUMERICAL METHODS

Solution of algebraic and transcendental equations. Curve fitting, Lagrange and Aithens interpolating polynomials. Errors. Difference calculus. Newton forward and backward difference formulae. Approximation of functions. Numerical differentiation and integration. Numerical solution of systems of linear equations. Numerical methods for differential equations.

MCB 301: BACTERIOLOGY

Bacterial morphology, biochemical characteristic and life cycle. Bacterial taxonomy. Systematic study of bacteria and other prokaryotes – nature, characteristics, isolation, identification and classification. Structure and functions of bacterial components-cell wall, cell membrane, pili, flagella, outer membrane, periplasm, capsule, e.t.c. spheroplasts, L-forms, Mycoplasmas. Isolation, purification, classification and identification of Bacteria; Properties used in bacteria classification-DNA based composition, DNA hybridization, colony morphology, Grams staining, Acid Fast Staining, Biochemical tests. Economic importance of bacteria. **Pre-requisites: MCB 201/202**

BCH 301: ENZYMOLOGY

General properties of enzymes. Enzymes as proteins and non proteins. Enzyme classification & nomenclature. Enzyme specificity, Measurement of enzyme activity. General enzyme assays. Methods of monitoring enzyme assay. Oxygen electrode. Coupled assays, Enzyme time-product relationship. Effect of substrate concentration, pH and temperature on enzyme activity. Precaution and controls in enzyme assays. Enzyme kinetics, derivation of Michaelis-Menten equation. Graphical determination of kinetic parameters. Irreversible and reversible inhibition of enzyme catalysis. Penicillin as an irreversible inhibitor. Coenzymes, cofactors, and prosthetic groups. Vitamins as coenzymes. Allosteric enzymes. Isolation & purification of enzymes.(Pre-requisites: BCH 201, 202)

CHM 305: ORGANIC CHEMISTRY II (2,0,1)

Nucleophilic substitution at a saturated carbon. The S_N1 , and S_N2 reactions. Effects of leaving groups, solvents on nucleophilic substitutions. Participation of Neighbouring groups in nucleophilic substitution. The Walden Inversion. Asymmetric synthesis. Nucleophilic addition to unsaturated sites. Enolates reactions Elimination reactions and stereochemistry of eliminations. Hoffmann and Bredt's Rule. Electrophilic, addition to multiple bonds, stereochemistry of electrophilic additions molecular rearrangements Pericyclic reactions. Kinetally and equilibrium controlled products. Application of structural concepts top reactivity. Stereospecific and stereoselective reactions. **Pre requisition CHM 20.**

BTC 301: BIOSTATISTICS (1,0,0)

Introduction to Biostatistics, Numerical Statistics, Arithmetic Average, Mean, Mode, Median and Standard Deviation, Standard Error, Graphs, Pit Charts, Bar Charts/Histograms, Inferential Statistic, T-test, Chi-Square, Probability, Bernoulli, Principles of Regression, Correlation, Uses of Computer

CHM 303: INORGANIC CHEMISTRY(2,0,1)

Periodic classification as function of electronic configuration of elements. Electronics structures, valence, stereochemistries and Group trends in Group VI and VII elements. Definition and general characteristics of Transition elements the position of Transition elements in the periodic table Electronic configuration of the atoms and ions of Transition elements. Origin of Paramagnetic Moments. Diamagnetism, Magnetic susceptibility and magnetic moments electron spin Resonance Optional activity and its application in the Transition element compounds, metal-metal bonding and metal atom clusters in Transition elements. **Pre-requisites: CHM 202**

BCH 302: METABOLIC PATHWAYS I

Degradation and digestion of carbohydrates. Intermediary metabolism. General aspects of biological oxidation. Glycolysis/Fermentation. TCA cycle. Phosphogluconate pathway, Glyoxylate cycle, Cori cycle, gluconeogenesis, and glycogenesis, glycogenolysis Calvin pathway, glycogen storage. Disorders of carbohydrate metabolism. Blood lipids (including lipoproteins). Synthesis of saturated and unsaturated fatty acid. Interconversion of fatty acids. Polyunsaturated fatty acids, Degradation of fatty acids (α , β and ω -oxidation), Disorders of lipid metabolism. Diabetic ketosis/acidosis. Formation of ketone bodies utilization of ketone bodies.

(Pre-requisite: BCH 201, 202)

BCH 303: BIOCHEMICAL TECHNIQUES

Principles of instrumentation. Dialysis, pH, Electrophoresis-principles and applications. Molecular differences between the different genotypes and their electrophoretic movements. Types of chromatography-thin layer, gel filtration, ion exchange and affinity chromatography, paper chromatography, etc. HPLC, Gas chromatography, Spectroscopy and spectrophotometry. Atomic Absorption spectrophotometry. Liquid scintillation counters. Enzyme-linked immunosorbent assay (ELISA). Microanalysis in biochemistry. Centrifugation. Practical laboratory exercise in areas of interest of academic staff to cut across a wide spectrum of general biochemistry.

(Pre-requisites: BCH 201, 202, 301, 302)

BCH 304: BIOPHYSICS

Chemical kinetics, catalysis & activation energy, Chemical and electrochemical potentials. Thermodynamics of energy-rich compounds. Electron transport chain and oxidative phosphorylation. Biological oxidation and reduction. Regulation of ATP production. Thermodynamics of open systems. Steady state and rapid equilibrium states.

Mitochondrial transport process. Isotopy and radioactivity in biochemical research. Physico-chemistry of sensory organs, cellular homeostasis.

(Pre-requisites: BCH 201, 202).

BCH 307: MEMBRANE BIOCHEMISTRY

Structure, composition and function of biological membranes and membrane-associated processes. Micelles, membrane bilayers and liposomes. Molecular organization of membrane components. Isolation, characterization and classification of membranes. Transport across biological membranes. Transport systems for sugars and amino acids. Diseases affecting membrane transport systems.

(Pre-requisites: BCH 201, 202)

BCH 308: BIOSYNTHESIS OF MACROMOLECULES

Structure and functions of macromolecules, complex carbohydrates (including mucopolysaccharides, glycoproteins, proteoglycans, and bacterial cell wall polysaccharides). Branched-chain lipids; lipoproteins. Cholesterol, eicosinoids, complex lipids, polynucleotides, nucleoproteins.

(Pre-requisites: BCH 201, 202, 301)

BCH 309 INTRODUCTION TO IMMUNOLOGY AND IMMUNOCHEMISTRY

Basic concepts of immunology. Structure and classification of antigens, hapten and immunoglobulin superfamily. Antigenic determinants Antigen-antibody reactions: agglutination (influence of ABO blood groups), precipitation, haemoagglutination inhibition. Natural immune response phagocytosis, inflammation,

natural flora as a natural barrier. Hypersensitivity of immune response, immunoprophylaxis and serotherapy. Mechanisms and theories of antibody formation. Functions of different antibody classes. Practical techniques on immunology and immunochemistry.

BCH 310: CELL & TISSUE BIOCHEMISTRY

Cell types and characteristics. Cell organelles. Functions and biochemical compartmentalization. Interrelationships between organelles. Cell division and associated biochemical events. Biochemical mechanism involved in cell growth and differentiation. Molecules associated with mechanisms of ageing and death. Cancer stem cells and totipotency. Transgenic animals. Elementary techniques in cell and tissue culture. Biochemistry of muscles, kidney, liver and adipose tissues. General biochemistry of the brain and neurochemistry. Biochemistry of reproductive tissues and reproduction, LH, FSA, Destrogen and Progesterone cycles.

Detoxification and excretion. Interdependence of various tissues. In vitro studies of intermediary metabolism using organs, tissues and tissue fragments. Biochemistry of abnormal tissues. Recent advances in tissue biochemistry.

(Pre-requisites: BCH 303, BCH 301).

BCH 312: INTRODUCTION TO CLINICAL BIOCHEMISTRY

Organ (liver, kidney, heart, etc) function tests. Blood chemistry and blood functions including blood clotting mechanism. Molecular diseases. Haemoglobinopathies, endocrine systems, other body fluid including cerebrospinal fluid, synovial fluid, aqueous and vitreous humors, intestinal fluid, tears and semen, their chemistry and functions. Metabolic disease including diabetes. Biochemistry of Rigor mortis. The immune system. Antigen – antibody interactions. Immunoglobulins: structures and functions. Complement systems. Diseases of the immune system – HIV/AIDS etc. Implications of low/high immunoglobulin levels.

ENS 301: INTRODUCTION TO ENTREPRENEURSHIP AND INNOVATION

Development entrepreneurship/intrapreneurship, the Nigerian entrepreneurial environment, creativity and intellectual rights, technological entrepreneurship, innovation: theories and management, family business and succession planning, women entrepreneurship, social entrepreneurship, business opportunity set and evaluation, introduction to business strategy, introduction to business ethics and

corporate governance, relationship between scientific research innovation and products, product invention, timeliness and processes.

MCB 306: MICROBIAL GROWTH AND GROWTH KINETICS

Cellular composition, Macronutrients, Micronutrients; Nutritional types, Growth factors/accessory nutrients, Prototrophs and auxotrophs. Cultivation of Microorganisms; Culture Media; Types and Forms; Culture Vessels; Liquid Culture, Culture on Solid Media, Tissue Cultures; Isolation of pure culture, Pure culture techniques-spread, streak and pour plate methods, Colony morphology description. Closed culture and open culture systems; Batch culture, Continuous culture – Special fermentation system, Chemostat, Dilution rate $\mu\theta$ /Residence Time, Turbidostat, Fed Batch, Extended Batch, Synchronous Cultures. Balanced and Unbalanced Growth; Shift responses. Nutrient uptake, passive Diffusion, Facilitated diffusion, Active transport, ATP and Binding protein dependent active transport mechanisms, PMF dependent active transport mechanism – antiport, Uniport and symport, Group translocation, PEP; PTS – enzymes,. Growth Kinetics; Mathematics of Growth, Growth rate constant, K, Generation Time, g, number of generation, n. Measurement of growth – cell numbers, Cell Mass, Determination of metabolic product, Determination of Consumption of substrate (e.g. O₂). Growth Yield (Y); Effect of nutrient concentration on growth yield, Effect of nutrient concentration on growth rate, Effect of limiting nutrient on growth. Effect of environment on growth; pH, temperature, O₂, Pressure, Radiation. Control of microbial Growth; Physical methods, Chemical agents, Conditions influencing effectiveness of antimicrobial agents, Evaluation of antimicrobial effectiveness. ***Pre-requisites: MCB 201/202***

ENS 302: BUSINESS CREATION, GROWTH AND CORPORATE GOVERNANCE

Concept of business and new value creation, introduction to theories of growth, business strategy, sources of capital, principles of marketing, business ethics and social responsibility, opportunity sets and expansion considerations (E-commerce, E-business, e-trade), the scientist/engineer as an entrepreneur; opportunities and challenges, managing transition (start up, growth), basic accounting literacy, feasibility and viability studies including issues in cash flow analysis, crafting business plans, corporate governance and change management.

BTC 307: GENETICS (2,1,0)

Historical background and model works, basic terminologies, chemical nature of the gene and gene characteristics. Aspects of human genetics and common genetic diseases, pedigree analysis; population genetics, Hardy – Weinberg principle, sex determination, sex linkage, multiple allele mutation, molecular basis of inheritance DNA,

RNA and Protein Synthesis, Composition, structure and replication of DNA. **Pre-requisites: BIO 103/104**

BTC 309: MOLECULAR BIOLOGY

Review cytochemistry of nuclear, DNA content of nuclear, DNA and cell protein Synthesis and Cell cycle. Molecular biology of muscles

- i. Striped
- ii. Striated
- iii. Smooth

Biochemistry of muscles. The sliding theory of muscle contraction, molecular neurobiology. General organization of a neuron, synaptic transmission, molecular biology of receptors. Ribosomes and Synthesis of protein turnover in cells. A preliminary overview of protein biosynthesis.

Genetic code' 1st, 2nd and 3rd base combinations, structures, compositions and assembly or ribosomes.

MCB 401: ANALYTICAL MICROBIOLOGY AND QUALITY CONTROL

Pure culture technique (revision), Isolation of auxotrophic bacteria, Microorganisms as reagents in qualitative analysis (bioassays); selection of test organism for bioassay (e.g. antibiotics amino acids, vitamins etc) Responses of microorganisms used in bioassays, obtaining and measuring responses, methods of bioassays and interpretation of results. Prediction of chemical toxicity against microorganisms. Determination of toxicity thresholds (Microbiological). Aspects of quality control with emphasis on food and pharmaceutical and other industries. Concept of HACCP, plant and equipment sanitation (revision,) microbiological standard and specifications – food laws and acts; food regulation and standards, food regulatory agencies, function of regulatory agencies e.g. NAFDAC, SON, etc, food standards – criteria and recommended limits.

BCH 401: METABOLIC PATHWAYS II

Digestion, absorption and metabolism of proteins, amino acids. Metabolism of individual amino acids. Integration of metabolic pathways. One-carbon units. Protein synthesis including involvement of RNAs. Urea cycle. Disorders of protein and amino acid metabolism. Types and functions of RNAs. Metabolism of purines, pyrimidines, nucleosides & nucleotides. Abnormalities in nucleic acid metabolism – e. g. Xeroderma

pigmentosum and skin cancer, etc. Experimental approach to study of metabolic pathways (like fermentation of lactate to ethanol, etc). (Pre-requisites: BCH 301, 302, CHM 305)

BCH 403: ADVANCED ENZYMOLOGY

Steady state kinetics. Significance of kinetic analysis. Theories of enzyme catalysis. Mechanism of enzyme catalysis. Active site-directed reagent. Spin label, affinity labels and general kinetic methods. Elucidation of types of amino acids occurring in active sites. Initial velocity studies. Mechanism of multi substrate enzymes. Investigation of co-operativity. Molecular models of allosterism.(Pre-requisite: BCH 301)

BCH 405: BIOTECHNOLOGY AND GENETIC ENGINEERING

Central dogma of Molecular Biology. Replication, transcription and translation – a brief review. The genetic code and its relationship to cellular functions. DNA replication in a cell-free system. Genetic transformation, transfunction and conjugation. Gene mutation, mutagenic agents and their applications to gene-transfer. DNA repair mechanisms and their disorders. Gene mapping. Structure of eukaryotic genome. Recombinant DNA and its application. Hybridoma.

BCH 407: BIOINORGANIC CHEMISTRY

An overview of the periodic table and general properties of elements. Relationship between the physiological ions. Role of inorganic elements in living systems. Ligand complexes and their biological significance. Metalloproteins. Deficiency of inorganic elements. Electrolyte metabolism. Nitrogen cycle & nitrogen fixation. Sulphur cycle. Carbon cycle.

BCH 409: METABOLIC REGULATION

The relationship of TCA cycle to protein, carbohydrate, lipid and nucleic acid metabolism. Integration of metabolic pathways. Turnover rates and metabolic pools. Regulation of enzymes of metabolic pathways. Feed-back inhibition versus enzyme synthesis. Catabolite repression, and product repression using the lactose operon and arabinose operon. Identification of different regulatory mechanisms in metabolic pathways. Hormonal and nervous system regulation of biochemical

mechanisms. Synthesis and degradation of enzymes as metabolic control methods. Life expectancy of enzymes. Regulatory mechanisms during protein and nucleic acid synthesis. (Pre-Requisites: BCH 301, BCH 302).

BCH 411: INDUSTRIAL BIOCHEMISTRY

A short review of microbial physiology and genetics. A review of general metabolic pathways. Control and applications in industrial processes. Culture methods, principles and applications. The chemostat and its applications in industrial fermentation. Fermentation-alcoholic, protein and amino acids. Production of antibiotics. Primary and secondary metabolites. Primary and secondary metabolism. Process evaluation and development. Overproduction of metabolites: amino acids, taste-enhancers, vitamins, toxins, etc. Screening and selection of microorganisms of industrial importance. Induction of mutagenesis in microorganisms and plants. Strain selection/development and enhancement. Gene dosage and its application in industrial processes. Use of enzymes in the food industry. Biochemistry of the production of beer, white wine, red wine, sparkling wine, vinegar, yoghurt, bread, etc. Cereal technology and the production of flour, kunu, burukutu, garri, fufu, tapioca, cassava flour, margarine, butter, vegetable oi;, biscuits, cake, cheese, toast, crackers and confectionaries. The Maillard reaction, formation of caramel and their consequences.

MCB 501: INDUSTRIAL MICROBIOLOGY AND BIOTECHNOLOGY 1

Definition of scope of industrial Microbiology and Biotechnology. A review of the history of current state of industrial Microbiology. Nature of Industrial Microbiology and Biotechnology. Industrial microorganisms. Culture collection, maintenance and Preservation. Parent and parency. Inoculum development.

Media formulation and Optimization of fermentation media. Some local potential sources of components of industrial media. Carbohydrate sources, protein source, use of plant waste materials, Sterility in industrial microbiology. Growth systems: Principles of microbial cultivation in aqueous systemic solid state cultivation and fermentation. Types of fomenter operations.

BCH 515: IMMUNOLOGY AND IMMUNOCHEMISTRY

Basic concepts of Immunology; structure of antigens, antigenic determinant, natural immune response- phagocytosis, inflammation, physical and chemical structures, normal flora as a natural barrier. Cells, tissues and organs of immune response; granulocytes, mononuclear phagocytes, dendritic cells, lymphocytes, humoral immunity-B cell activation, primary and secondary immune response, cell mediated

immunity – T-cell activation, functions of CD8 and CD4 cells, natural killer cells, cytokines. Genetics of response to antigenic stimulation (immunogenetics); principles and significance of immunogenetics, structure and classification of immunoglobulins and antibodies. Theories of antibody formation, clonal selection theory, the complement system – alternative pathway, lectin pathway, classical pathway. Hypersensitivity of immune response – immunodeficiency diseases the function of immune response in cancer antigen – antibody reaction – agglutination, precipitation, haemoagglutination inhibition, immunofluorescence, ELISA, complement fixation. Autopathology and autoimmunity characteristics, spectrum, super-antigen treatment. Tissue and transplantation immunology, immunoprophylaxis and serotherapy.

BCH 501: ADVANCED BIOCHEMICAL & MICROBIOLOGICAL METHODS

A practical course to familiarize students with operations of latest biochemical and microbiological equipment and with methods of research, assimilation and dissemination of information. Students will go round laboratories housing specialized equipment with the aim of exposing them to such equipment under the supervision of a lecturer. Part of the course will also cover the effective use of the library, preparation of dissertations or thesis, papers for journal publications and journal reviews. Special assignments and essays will be given to students. Operations of Biochemicals and Microbiological equipment – Spectrophotometer, Incubator, Fluorimeter. Electrophoresis, Thin layer and Paper Chromatography. Centrifuges – Tables and Refrigerated. pH meters Scintillation counters. Protein isolation, fractionation, purification and characterization are treated here. (Pre-requisites: BCH 301, 302, 401)

BCH 503: PHYTOBIOCHEMISTRY

Techniques of plant biochemistry such as cell fractionation. Structure and function of plant organization, physiology and biochemistry of plant organelles and its relationships. Respiration in storage tissues. Fruit development and ripening. Studies on increasing photosynthesis in crop plants. Regulation of crop growth and productivity. Biochemistry and genetic control of photorespiration. Respiratory patterns in plant breeding. Influence of herbicides in plant respiration and photosynthesis. Anaerobic respiration, flood and drought tolerance in plants. Salt resistance and ion toxicity in higher plants. Solar energy conversion and photosynthesis. Primary and secondary plant products e.g. Alkaloids, flavonoids and other phytochemicals. Plant hormones and their metabolism. Synthetic growth regulators. Lignin and lignan biosynthesis. (Pre-requisite: BCH 302)

BCH 505: SEMINAR TOPICS IN BIOCHEMISTRY

The student is expected to select a seminar topic for detailed study, using library methods. The emphasis should be on recent advances in the chosen area.

BCH 507: PHARMACOLOGICAL BIOCHEMISTRY

An overview of intermediary metabolism. Mechanism of Apoptosis. Cellular metabolism in infested cells. Biochemical aspects of host-parasite relationships. Biochemistry of named parasites like *Plasmodium*, etc. Metabolic factors affecting chemotherapeutic agents. Theories of the mechanisms of drug action. The cytochrome P₄₅₀ superfamily and their Biotransformation of drugs (phase 1 and phase 2). Drug resistance and other factors affecting drug efficacy. The physiological and biochemical modes of action of selected drugs. Biochemistry of the use of traditional medicinal plants in the management and therapy of common ailments (in Nigeria) like malaria, sickle cell anaemia, common cold, hepatitis, etc.

(Pre-requisites: BCH 301, BCH 302, BCH 303, CHM 305)

BCH 509: BIOCHEMISTRY OF FOODS & NUTRITION

Food nutrients. Energy value of foods and expenditure by mammals. Nutritive value of foods, carbohydrates, fats, proteins, vitamins, mineral elements and water. Nitrogen balance Nutritional status and nutritional requirements. Recommended dietary allowances. Assessment of nutritional status. Protein quality and methods for assessing it. Nutritional requirement in relation to physical activity, ageing, diet and diseases. Obesity, undernutrition and nutritional disorders. Basal metabolic rate (BMR) and resting metabolic rate (RMR). BMR and RMR in health and diseased states. Hydrosoluble vitamins. Co-enzymes. Liposoluble vitamins. Biochemical functions of trace elements. Processing, preservation and storage of foods. Introduction to the determination of food constituents. Bioavailability of foods and factors affecting it. Factors affecting digestion of food materials in the gastrointestinal tract.

(Pre-requisite: BCH 302)

BCH 517 – Pre – Project

A student is expected to partake in pre-project practicals. These practicals will help the student understand the basis of the research project (BCH 508).

BCH 511: CELL AND TISSUE CULTURE TECHNIQUES

Review of the structure of the plant cell. History and development of plant cell/tissue culture. Basic materials and methods including sterile techniques. Totipotency and its importance. Culture media and their handling. Culture of cell and tissue types e.g. single cells. Anthers, ovules, embryos, tumour and callus tissues. Protoplast isolation and culture. Applications of protoplast technology in crop improvement and gene transfer. Morphogenesis in cell cultures. Micropropagation, etc. Conversion procedures. Somaclonal variation. Transgenic plants. Current topics in cell/tissue culture techniques.

BCH 513: BIOCHEMICAL TOXICOLOGY

Biochemical toxicology, definition and scope, absorption and distribution, toxic kinetic, metabolism of toxicants; comparative toxicology; physiological factors affecting metabolism of xenobiotics elimination of toxicants and their metabolites, toxicant – receptor interactions, genetics poisons' chemical carcinogenesis; trace element toxicity, hepatotoxicity. Resistance and tolerance of toxicant, natural toxins, chronic testing in animals, short term tests for mutagenicity in the toxicological, evaluation of chemical modes of action of pesticides enzymatic basis of detoxication.

MCB 502: INDUSTRIAL MICROBIOLOGY AND BIOTECHNOLOGY II

Organic feedstock produced by fermentation: ethanol, acetone, butanol and glycerol. Organic acid production: Citric acid, gluconic acid, acetic acid. Wine, beer and other fermented alcoholic beverages. Bread and other fermented plant products. Amino acid production: Strategies for the over production of Amino acids, commercial uses of amino acids: L-glutamic acid, L-cystine; L-asparagine; protease, lipases of penicillin acyls. Nucleotides:

BCH 502: APPLIED ENZYMOLOGY

Protein purification and large scale preparation. Enzyme reactions in non-aqueous solvents. Enzyme immobilization. Enzymes in organic synthesis. Hydrolases and Oxidoreductases. Principles of *in-situ* biochemistry. Application of enzymes in food processing and environmental clean up/remediation. Industrial enzymes including isomerases. Clinical application of enzymes.

(Pre-requisites: BCH 301, BCH 403, BCH 407)

BCH 504: BIOCHEMICAL REASONING

Evaluation and design of experimental biochemistry from available information and data. Analysis, interpretation and inference drawing from biochemical research data. Elucidation of molecular bases of certain diseases/disorders (Pre-requisites: BCH 301, 302, 306, 401)

BCH 506: INDUSTRIAL POLLUTION AND WASTE MANAGEMENT TECHNOLOGY

Industrial waste definition, nature, types and sources. Industrial effluents from textiles, pharmaceutical, brewing, food and cassava processing plants, etc. Sampling techniques and preservation. Analytical methods for monitoring industrial effluents. Design, operation and management of treatment techniques (physical, chemical and biological). Hazardous wastes and their effects. Waste management strategies and disposal techniques.

(Pre-requisite: BCH 407)

BCH 508: RESEARCH PROJECTS IN BIOCHEMISTRY

A student will be expected to carry out an investigative research under the supervision of an academic staff in any special area of Biochemistry. The student shall write a project report and be examined for his/her knowledge of the work before a panel of external and internal examiners in an oral examination.

BCH 512: XENOBIOTICS & FORENSIC BIOCHEMISTRY

Adulteration of foods, drinks and drugs. Quality control of foods and drugs. Contamination of foods and drugs. Forensic and toxicological examinations. Determination of toxic substances in food, environment, body fluids and tissues. Detoxification and excretion of foreign substances. Biochemical mechanisms in toxicology. Metabolism of foreign compounds. Tests involving blood, urine and sweat. Xenobiotics and their biodegradability. Current issues in xenobiotic and forensic biochemistry.

(Pre-requisites: BCH 302, 403, 407)

BCH 510: BIOFUEL AND BIOGAS TECHNOLOGY

Biofuels. Raw materials for bioalcohol production. Types of bioalcohol-advantages of each. Process lines for bioalcohol production. Microorganisms used in bioalcohol production. Fermentation techniques for biogas production. Raw materials for biogas production, Microorganisms used in biogas production. Raw materials for biodiesel production. Types of biodiesel-advantages of each. Process line (batch and continuous) for biodiesel production. Production of biodiesel via (a) direct use and blending (b) microemulsions (c) thermal cracking (pyrolysis) and (d) transesterification. Kinetics of enzyme-catalysed reactions isotherms. Kinetics of biomass production. Transport reactors with special emphasis on fermentation system. Principles of process design, safety implications. Environmental mitigation for bioalcohol, biogas and biodiesel production. (Pre-requisites: CHM 204/305, BCH 301, 403)