1.0 BRIEF OUTLINE OF COURSE CONTENT

1.   MTH 101: ELEMENTARY MATHEMATICS I (3,1,0)

Number system, indices, surds and logarithms, polynomials. Remainder and factor theorem. Polynomial equations. Rational function. Partial fractions. Fields, ordered fields, Inequalities, Mathematics induction, Permutations and combinations. Binomial theorem, sequences and series. The quadratic equation and function. Relation between the roots and the coefficient. Complex numbers. Addition, subtraction, multiplication and division. Argand diagram, De-Moivre's theorem, n-th roots of complex number. Elementary set theory, Venn diagrams and applications. DeMorgan's laws. Trigonometry, Elementary properties of basic trigonometric functions. Additional formulae and basic identities. Sine and cosine formulae. Half angle formulae. Area of a triangle. Solution of trigonometric equations. Inverse trigonometric functions. Function, Concept and notation examples. Composition, exponential and logarithmic functions. Graphs and properties. Limits and continuity. The derivative calculation from first principle Techniques of differentiation, Chain rule/higher order derivatives. Extreme problems. Mean –value theorem. Applications. Indeterminate forms and L' Hospitals rule. Taylor and Machlaurin's series. Curve sketching. Integration as the reverse of differentiation, as area, as limit of finite sums, definite integrals. Properties of definite integrals. Applications.

Pre-requisite: Credit O'L Math

2.   PHY 101- GENERAL PHYSICS I (2,1,1)

Mechanics: Space and time, units and dimensions, vectors, kinematics, Newton's law, Galiliean invariance, statics and dynamics of particle, universal gravitation, work and potential energy, conversion of energy and momentum, rigid bodies, fluid mechanics. Thermal physics, thermal properties including elementary thermodynamics and kinetic theory. **Pre-requisites: Credit in O'L Physics and Mathematics and concurrent registration in Math 101.**

3.   BIO 101/103- GENERAL BIOLOGY (2,0,1)

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; interrelation- ship of organisms, elementary biochemistry of carbohydrates; Proteins and lipids structure and chemical characteristics. General classification of animal and plants; experimental morphology; classical genetics- Mendelism; molecular

basis of heredity; mutation and natural selection; ecology and population dynamics; bio-engineering. Science methods and characteristics of living and non living things. Cell and tissue biology. Elements of biological chemistry and cellular metabolism. Taxonomy of living things, heredity and evolution. Elements of ecology and types of habitats.

4.   ENG 101- WORKSHOP PRACTICE I (0,0,1)

General: Use of engineering measuring instruments, e.g. calipers, gauges, etc. Introduction to hand tools e.g. practice in wood planners. Sanders and pattern making; sampling and sizing techniques of raw materials. Sheet metal work: production of sheet metal products, layout, cutting and shaping, gas welding, soldering, brazing and fastening assembly. Woodwork: Basic woodworking principles and tools, layout methods, cutting and evaluation, finished products.

5.   ENG 103- ENGINEERING DRAWING I (0,0,1)

Introduction to the use of drawing/ drafting instruments. Descriptive geometry and geometry construction. Drawing, measuring, lettering and dimension objects in various position. Principles of orthographic projections in the first and third angle.

6.   GST 101- USE OF ENGLISH I (1,1,0)

Study aids through dictionary practice, vocabulary development techniques, reading and comprehension techniques, listening and note taking techniques, outlining and summarizing, speech work and review of examination questions.

7.   GST 103- PHILOSOPHY AND LOGIC (1,0,0)

This course aims at equipping the students with the capacity for critical, truthful and deep reflective thinking. These are qualities which are fundamental and indispensable for creative productive and objective academic research and excellence.

To this effect, this course will embrace such topics as the notion, origin and emergence of philosophy, fundamental philosophical attitude; importance value and division of philosophy; characteristics and major philosophical suptems and methods. Logical proposition and test validity; laws of thought; logical fallacies; value of logic and problems of philosophy.

8.   CHM 101: GENERAL CHEMISTRY I (2,1,1)

Atoms, molecules, chemical reactions, equations and stoichiometry. Modern electronic theory of atoms. Atomic structure and Electronic Configuration. Periodicity, the periodic classification of elements and building up of periodic table. Valence forces, intermolecular forces, and chemical bonding. Solids and their structure. Dipole-dipole interactions and its effect on physical properties. Redox reactions. Rates of reaction, chemical equilibrium and equilibrium reactions. Elementary electrochemistry. Introduction to gas kinetic, Properties of gasses. Basic chemical kinetic and chemical thermodynamics. Theory of acids and bases, acid-base reactions, pH, Solubility and solubility product. Radioactivity. Elementary Thermochemistry. **Pre-requisite: credits at WASC/GCE O/L Chemistry.**

9.   FRN 101; FRENCH LANGUAGE I (1,0,0)

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.

10.   IGB 101: IGBO LANGUAGE I   INTRODUCTION TO IGBO GRAMMER, COMPOSITION AND COMPREHENSION (1, 0, 0)

This course will equip the student with the basic language skills, listening, speaking, reading and writing in the approved 1961 orthography as the basics for standards Igbo.

Igbo history and origin, evolution of Igbo written language, Igbo alphabets and word features (for the state of non-Igbo students), parts of speech, Igbo phrases and clauses, sentence patterns, elements of simple sentence, (subject, verb compliment and adjunct), principles of Igbo syllables and structure, vowel harmony, Tone and tone drills, Translation, composition (types and style styles of composition) organization and language use, comprehension, summary skills, exercise in oral delivery, public speech and address in Igbo, spelling in Igbo.

Transcendental functions. Hyperbolic function. Inverse functions. Logarithmic differentiation. Method of integration. Integration rational functions. Integration by parts. Improper integrals. Applications. Area and volumes. Centre of mass. Ordinary differential equations. First order linear equation, second order homogeneous equations with constant coefficients. Applications. Plane analysis geometry. Rectangular Cartesian coordinates. Distance between two points. The straight line loci. The circle, Parabola, ellipse and hyperbola. Second degree curves. Plane polar coordinates

vectors. Graph of polar equations. Plane areas in polar coordinates. Vectors. Vector function and their derivatives. Velocity and acceleration. Matrix. Algebra. Addition and multiplication Transpose. Determinants. Inverse of non- singular matrices. Cramer's rule and application to the solution of linear equation. (examples should be limited to m,n matrices where m=3, n=3) transformation of the plane. Translation, reflection, rotation. Enlargement, shear composition of transformations. Invariant points and lines.

12. GST 102: USE OF ENGLISH II (1,1,0)

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

13. FRN 102: FRENCH LANGUAGE II (1,0,0)

Here the students will be drilled in French grammar proper, dialogue and other oral exercises. The student will also be introduced into reading, starting with France Afrique book 1. At the end of this course the students should be able to speak basic French and be able to tell time in French.

14. IGB 102: INTRODUCTION TO IGBO HISTORY, CULTURE AND LITERATURE (1, 0, 0,)

This course will expose 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 perspective, their aspirations and amenities, as some contemporary texts will be incorporated in the study.

Greetings and respect in Igbo land, Igbo hospitality (Kola nuts and presentation): Igbo institutions: marriage, family, social culture institutions, economic institutions, religious institutions, health institution, political institutions. Relationships with neighbors, myths

and taboos, life and death, burial rights, Igbo belief systems, scope of Igbo literature, genres and features of Igbo literature, survey of written works in Igbo language prose, poetry, drama and excursions.

15.   ENG 102- WORKSHOP PRACTICE II (0,0,1)

Industrial safety, behaviours analysis, safety consciousness, survey of sources of common accidents, accident prevention and control, machine- shop work, lathe work, instruction of metal working process, shaping, milling grinding, and metal spinning etc. design of simple jigs and fixtures, automobile work, simple automobile diagnosis and repairs, electrical workshop practice, convention and application of colour codes and signs, etc. use of electrical tools, machines, cables and conductors.

16.   ENG 104- ENGINEERING DRAWING II (0,0,1)

Isometric projection. Freehand and guided sketching, sectioning conventional practice, conic sections and development, methods of reading and reproducing drawings, graphs and charts. Interpretation of solids.

17.   GST 108- SOCIAL SCIENCE I (1,1,0)

Introduction: The nature and scope of politics and economics: Definition of basic concept in economics and political science. Nigeria's public sector: the political set-up in Nigeria: civil service structure: Public investment and Economic infrastructure: The economic role of government; government expenditures and revenues, fiscal federalism and revenue allocation.

18.   GST 110- SCIENCE, TECHNOLOGY AND SOCIETY (1,0,0)

This course links science to its philosophical origin and shows how both impact on society, man and technological development. This course will cover such areas as the etymological and philosophical origin of science; science and non-science, science in its generic and specific division; its goal, characteristics and presuppositions; specific methods and method in science; its goal, characteristics and presuppositions.

19.   PHY 102- GENERAL PHYSICS II (2,1,1)

Electricity and magnetism, electrostatics; conductor's currents, dielectrics; magnetic fields and induction, Maxwell's equation; electromagnetic oscillations and waves. Geometrical optics; geometrical methods applied to the optics of mirrors, lenses and prisms. **Pre-requisites: Previous registration in PHY 101 and MTH 101**

20.   CHM 102: GENERAL CHEMISTRY II (2,1,1)

Historical survey of the development and importance of Organic Chemistry; Fullerenes as fourth allotrope of carbon, uses as nanotubes, nanostructures, Nano chemistry. Electronic theory in Organic Chemistry. Hybridization and shapes of simple molecules. Isolation and purification of organic compounds. Determination of structures of organic compounds including qualitative and quantitative analysis in organic chemistry. Organic formulae and structure, Homology and Isomerism, Nomenclature and functional group classes of organic compounds. Survey of reactions of functional groups in aliphatic and aromatic compounds, Introduction to chemistry of alkanes, alkynes, haloakanes, alkanols, ethers, nitriles, amines, aldehydes, ketones, carboxylic acids and their derivatives. Introductory reaction mechanism and kinetics. Stereochemistry.

21.   CHM 201: PHYSICAL CHEMISTRY I (2,0,1)

Kinetic theory of gases; science of real gases and Ideal gases, Equation of state for real gases. Thermodynamic concepts, process, first, second, third laws and parameters. Reversible and Irreversible processes. State functions and path function. Entropy and free energy; reactions and phase equilibria; chemical Kinetics-rates of reactions, and rate laws. Thermochemistry, Lattice enthalpy, chemical Equilibrium mechanism and theories of elementary processes; photochemical reactions; basic electrochemistry.

Pre-requisite CHM 101

22.   CHM 203: CHEMICAL PROCESS SCIENCE I (2,0,1)

Commercial process, problems of scale and cost. Process flow sheet and stoichiometry handling of fluids conservation and dimensional analysis applied to a moving process heat transfer, mechanisms of heat transfer in batch and continual processes. Use of mean temperature difference, change of phase correlation of transfer data distillation differential, batch, fractional and continuous fraction distillation; number of stages, effects operating variables.

23. MTH 201- MATHEMATICAL METHODS (2,1,0)

Functions of two or more variables. Limits and continuity. Partial derivatives, directional derivatives, tangent plane and normal line. Gradient, chain rule, total differentiation. Implicit functions. Jacobian 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, volume centres of mass moments of inertia etc. infinite sequences and series. Tests for convergence. Absolute and conditional convergence. Power series.

24. STA 211- STATISTICS (2,1,0)

Frequency distributions, measures of location and dispersion in simple and grouped data. Laws of probability. The binomial poisson and normal distributions. Estimation and tests of hypothesis. Assembly drawing of engineering system models. Preparation of parts and a given assembly.

25. CSC 201: COMPUTER AND APPLICATION (2,1,1)

Brief history of computer and computer generation. Classification of computers. Structure of a general purpose computer. Number systems. The stored program. Technique of problem solving. Flow- charting. Stepwise refinement. Algorithm for searching, sorting and merging of ordered lists. Data preparation. I/O devices. Data type. Data representation. Data capture. Problem- oriented languages. Visual basic basic+, introduction to C and FORTRAN programming: arithmetic expressions; assignment statement; I/O commands; logical expression; arrays, sequencing, alternation and iteration; sub -programmes and parameters. Elementary numerical algorithms. **Pre-requisite: MTH 101 and MTH 102**

26. ENG 201: WORKSHOP PRACTICE III (0,0,1)

Foundry: sand testing, mixing of sands, preparation of moulds. Pattern making- solid, split sweep pattern, hoisting gates and rises, melting and pouring of metals. Detection of defects. Welding: manual arc welding- butt, T- joints, edge preparation, surface cladding argon arc welding, CO_2 MIG welding, SA.   **Pre-requisites: ENG 101 and ENG 102**

27.   GST 201: NIGERIA & AFRICAN CULTURAL DEVELOPMENT II (1,0,0)

Study of Nigeria history/culture and arts in pre-colonial times, Nigerians perception of his world; culture areas of Nigeria and their characteristics, evolution of Nigeria as a political unit, indigene/settle phenomenon; concepts of trade, Economics of self-reliance, social justice, individual and natural development, norms and values, negative attributes and conducts (cultism and related vices), re-orientation of moral and national values, moral obligations of citizens, environmental problems.

28.   CHM 202: INORGANIC CHEMISTRY I (2,0,1)

Chemistry of first row transition metals. Chemistry of the s-p- and d-block elements, hydrogen, noble gases, group I, II, III, IV and V. Periodicity of the elements illustrated by a study of their simple hydrides and halides Comparative chemistry of the following elements: (a) Ga, In, Ti, (b) Ga, Sn, Pb, (c) As, Sb, Bi, (d) Se, Te, Po. Relationship between electronic structure, size and reactions of compounds. Solid state structures of simple AB and AB_2 compounds of the s, p and d block elements. Crystalline solids and crystal defects. Polymorphism. Theory and principles of qualitative and quantitative inorganic analysis. Separation of elements into analytical groups by the solubility of their compounds in qualitative inorganic analysis. **Pre requisite CHM 101 and 102**

29. CHM 204: ORGANIC CHEMISTRY I (2,0,1)

Aromaticity and functional group chemistry in aromatic and aliphatic compounds. Survey of representative polycyclic compounds and simple alicyclic carbon compounds and their synthesis. conformation and conformational isomerism. Stereochemistry and stereoisomerism. Modes of bond formation and fission in organic compounds electronic and steric effects, energetics. Kinetics and investigation of reaction mechanisms. Mechanisms of substitution, elimination, addition, rearrangement reactions, and free radical reactions. Kinetic and Thermodynamic control of products. Nucleophilic and electrophilic substitution reactions. Functional group analysis. Structures and brief introductions to simple sugars, starch and cellulose, peptides, proteins. Chemistry of bi-functional compounds. **Pre requisite CHM 102**

30.   CHM 206: INDUSTRIAL RAW MATERIALS RESOURCE INVENTORY   (2,0,0)

Survey of chemical and related industries and sources of raw materials, minerals, chemical fossils and their uses for the chemical industries in Nigeria. Plant and animal products. The economic importance and general characteristics of the chemical industry. Introduction to chemical technology processes, mineral processing and chemical plant operations. Nuclear, solar, aerodynamic, hydrodynamic sources of energy. Potential and applications of locally available materials as industrial feedstock Importance of research and development, capital, labour requirements, technical and sales services. Basic requirement for setting up a chemical factory.

31. CHM 208: CHEMICAL PROCESS SCIENCE II (2,1,0)

Mass transfer processes, single phase and inter-phase, drying as a mass transfer process. Extraction and absorption; solvent extraction in mixer settle columns, number of ideal stages, number of stages in gas absorption by HTU gas films and liquid film rate determining steps. Solid-liquid separation by filtration and sedimentation. Stoichiometries for systems involving recycles. **Pre requisite CHM 203**

32. MTH 222: INTRODUCTORY NUMERICAL ANALYSIS (2,1,0)

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

33.   ECN 204: INTRODUCTION TO INDUSTRIAL ECONOMICS (2,1,0)

Scope and methods of industrial Economics. Theory of the firm. Nature and forms of business organization, industrial structure. Market. Forms of market. Business pricing practices. The integration of economic activities of industries. Business combinations. Government and industrial Economics. Forecasting for firm's products, demand and supply.

34.   CHM 301: PHYSICAL CHEMISTRY II (2,0,0)

A review of Gibbs function. Chemical thermodynamics, First Law of thermodynamics, applications of thermochemical measurements. Thermodynamic principles of equilibrium. Second Law of Thermodynamics. Entropy and variation with temperature; Third law, Free energy and conditions for equilibrium at constant temperature and pressure. Chemical potential and dependence on the properties of the system. Introduction to statistical thermodynamics and Statistical mechanics, Clapyron–Clausius equation and phase transition. Maxwel–Boltzman statistics. Colligative properties, ideal solutions and non-ideal solutions. Properties of electrolytes, Oxidation and reduction reactions. Energy bands theory of bonding in metals, conductors and semi-conductors. Concepts of hard and soft acids and bases. **Pre-requisite: CHM 201**

35.   CHM 303: INORGANIC CHEMISTRY II (2,0,1)

Introduction to coordination chemistry, including elementary treatment of Ligand and Crystal Field Theories. Elementary introduction to organometallic chemistry. 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. The importance of magnetron in transition elements. Origin of Paramagnetic moments. Diamagnetism, magnetic susceptibility, magnetic moments and electron spin resonance. Optical activity, Stereo- chemistries and Group trends in Groups VI and VII elements and thier applications in the transition element compounds, metal-metal bonding and metal atom clusters in transition elements. Role of metals in biochemical systems. Introduction to radiochemistry. Radioactivity. **Pre-requisite CHM 202.**

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

Nucleophilic substitution at a saturated carbon. The SN_1, and SN_2 reactions. Effects of leaving groups, solvents on nucleophilic substitutions and participation of neighbouring groups. 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. Kinetically and equilibrium controlled products. Structural concepts and reactivity. Stereospecific and stereo-selective reactions. Examples of various named organic reactions e.g. Grignard reactions, Aldol and related reactions. Selected rearrangement reactions and pericyclic reactions, e.g. Beckmann, Baeyer-Villager etc. Reactive intermediates - carbonation, carbanions, carbenes, nitrenes etc.

Pre requisite CHM 204

37.   CHM 307: ANALYTICAL CHEMISTRY I (2,0,0)

Types of sampling methods. Theory of sampling methods, Statistical treatment of experimental results. Significance of laboratory results, tolerance and confidences limits. Theory of errors, accuracy and precision of measurements. Separation methods. Types of chromatography as separation methods. Types of chromatography. Spectroscopic methods of analysis; emission, absorption, fluorescence and phosphorescence phenomena, optical method of analysis / chemical methods of analysis including volumetric, gravimetric, titrimetric methods and physiochemical methods.

Pre-requisite Year II standing i.e. Passes in all CHM courses since Year I.

38.   CHM 309: EXPERIEMENTAL CHEMISTRY (0,0,1)

Experiments in crystallization as a means of separation and purification. Extraction of oil from orange peels, lemon grass extraction of iodine from aqueous solutions, Quantification of extraction processes. Distillation of binary mixtures and fraction. Refluxing and establishment of reflux ratios. Identification by thin layer and paper chromatography, R_f values. Standard preparation and quantification with UV/visible spectrometry.

Pre-requisite: co-registration with CHM 307.

39.   CHM 311: STRUCTURE AND BONDING

Quantum numbers, boundary surface of atomic orbitals and their energy levels. Idea of quantum states, orbitals, shape; and energy. Simple valence theory, electron pair repulsion theory, atomic spectra methods of determining molecular shape, bond length and angles. Linear combination of atomic orbitals approximation Vs Valence bond treatment of covalent bonds. Homonuclear and heteronuclear diatomic molecular orbitals. Ionic character of covalent bonds, molecular crystals, bond lengths and energies. The structure and chemistry of some representative main group element compounds. **Pre-requisite-CHM 101 and 102**

40.   CHM 313: PHYSICAL ORGANIC CHEMISTRY   (2,0,0)

Stepwise and concerted reaction mechanism. Unimolecular and biomolecular processes. Kinetic and non-kinetic/thermodynamic studies. The effect of structure, environment, nature of the nucleophile, solvation factors, added salt etc. The causes

and rates of reactions. stereochemical concepts; Preparation and reaction of stereo isomers, stereo selectivity .symmetry of orbital. Linear free energy relationships. The Ham equation: determination of constituent and reaction constants: significance and use of signs and symbols to + 6m/P+0+6+m/o application to evaluation of mechanism pathways. **Pre-requisite: CHM 204**

41. CHM 315:   PETROLEUM CHEMISTRY (2,0,0)

Petroleum in the contemporary energy science. Nature, classification, composition and distribution of crude petroleum and natural gas Distribution of Petroleum and natural gas resources (the global and Nigeria situations). Petrochemicals in Industrial raw materials. Prospects for the petrochemical industry in Nigeria. The chemistry of refinery processes and products, petrochemical as industrial feedstock's. Hydrogenation of coal, forms of carbon other than coke. Oil refining, Crude oil and distillation processes, Naphtha cracking and derivatives. Steam reforming, catalytic cracking and desulphurization, Hydrocracking. The octane number, Cake-making and its bye-products. Free radical cracking and carbonation cracking products. Analysis of crude oils, analytical parameters e.g pour point, cloud point, specific gravity, moisture content, flash point etc. and other international analytic standards.

Pre-requisites: CHM 204

42. ICH 301:   INDUSTRIAL CHEMICAL PROCESS   (2,1,0)

Production of primary intermediates and synthesis of industrial organic chemicals. Polymers, adhesives, dyes, explosives, insecticides, pesticides, herbicides, flavoring agents and pharmaceuticals. Fermentation process. Chemical Processing of minerals. Metallurgy and hydrometallurgical processes. Industrial electrochemistry. manufacture of some heavy inorganic chemicals. Cement and binding materials. Inorganic fertelizers.

43. ENS 301: ENTREPRENEUR STUDIES (2, 0, 0)

The design and flow of the course are aimed at creating awareness and providing the knowledge and skills that are important in achieving success in human endeavours as a value addition to the student's chosen field of specialization. The course outline is made up of the following topics:

Development of Entrepreneurship / Intrapreneurship Creativity and intellectual rights Innovation: theories and management Women entrepreneurship Business opportunity set and evaluation. Introduction to business strategy   Introduction to business ethics and corporate governance

47. CHM 308: APPLIED SPECTROSCOPY (2,1,0)

Qualitative and quantitative application UV and visible spectroscopy. Emphasis on actual interpretative of spectra of substances– Interpretation of Spectra Energy of electronic excitation, absorption laws, selection rules and types of chromospheres, solvent effects. Infrared spectra; principles of infrared absorption, types of vibration modes, use of the table of characteristic group frequencies, Interpretation NMR, Mass spectroscopy – principles – Interpretation of spectra. Principles and applications of UV, IR "NMR and Mass spectroscopy in structural determination of organic and inorganic compounds. Brief mention of hyphen systems: GC-MS, LC-MS and LC-NMR in medicine.

48. CHM 310: INTRODUCTION TO PHARMACEUTICAL CHEMISTRY (2,0,0)

Biochemical pharmacology: Introduction, Pharmacokinetics, absorption and distribution. Factors affecting metabolism and drug action. Drug-receprocate interactions. Neuromuscular and ganglionic blockade sympathominetics: adrenaline receptors: adrenergic neuron antagonistics. Autocoids: Histamine: Serotonin: polypeptides: Prostaglandins and related substances: antiallergic, antinflamentory and antipyretic agent. Bioassay of drugs Generally-acting drugs. Opiates, receptors and antagonistic: Dopamine receptors and antipsychotic drugs: antidepressants: anti-anxiety drugs. Selective toxicity: The basic selective toxicity. Survey of host of defence mechanisms and the use of chemotherapy in bacteria cell membrane, effect on its permeability - role of antifungals. Felix acids, the role of anti-metabolites. Drug resistance, protein synthesis and its interference. Natural products as a source of new drugs. Existing drugs. Existing drugs as a source of new drugs, introduction to chemotherapy. Suphonamides, Antimalarials – plasmoquin, choloroquine, Palestrina, Arsenicals, Antibiotics Penicillin's, synthetic penicillin's. Disease models as screens for New Drugs. Drugs Analysis of drugs pharmacopoeia. **Pre-requisite CHM 204**

49. CHM 312: SEPERATION METHODS AND ANALYSIS (2, 0, 1)

Intermediate theory and laboratory techniques in analytical and physical chemistry. Advanced data analysis methods and goodness of it criteria spectroscopic methods instrumentation, separation methods: ion exchange, gas, paper, liquid, and column chromatography, electrolysis. Atomic and molecular absorption. Quantitative analysis ray methods. Refractometry, interferometry, polarimetry, polarography and calorimeter.

50. CHM 314: ATOMIC AND MOLECULAR STRUCUTURE AND SYMMETRY (2,1,0)

Schrödinger equation. Helium atom, ground and excited states, Spin and Pauli Principle, Hydrogen molecule; Comparison of molecular orbital and valence bond theory, concept of resonance and configuration interaction. Coulson Fischer function. Molecular orbitals for diatomic molecules. Simple pi electron theory, Huckel theory, Walsh rules, Rotational, Vibrational and Electronic Spectra. Applications for determining bond lengths and angles. Brief mention of other methods. Atomic spectra, Russell-Saunders coupling, orbital and spin angular momentum. Use of symmetry in Chemistry.

51. PTE 312: POLYMER PROCESSING TECHNOLOGY I (2,0,1)

The properties, methods of manufacture and applications of synthetic resins, compounding and processing of plastics and elastomers; compression moulding, injection, vacuum forming, plasyication, blowing, calendaring, casting, extrusion, foaming, fillers, plasticizers, additives, properties of thermoplastic testing

52.   ENS 302: ENTREPRENEUR STUDIES (2, 0, 0)

The aim of this course is to develop student's competence and confidence in creating valuable businesses with high potentials for value addition and commensurate actions. The course is designed to enable students achieve economic independence after graduation. Its main objectives are to help change student's mind-set towards paid jobs and over-dependence on families and government. By the end of the course students will have the capacity to identify opportunity sets or need-gaps in the society, take advantage of such gaps and midwife them to generating employment, create wealth and efficiently allocate and utilize productive resources.

53.   PTE 316: CHEMICAL PROCESSING OF TEXILES (1,0,1)

Preparatory processes e.g. singing, de-sizing, scouring, bleaching: batch and continuous processes; classification of dyes and intermediates; wing, jig and padding; printing types and styles; principles and practice of finishing fabrics, cotton, rayon, and wool; classification of various finishes, finishing machineries, mangles and   their functions, drying machines, stentering, damping and calendaring. Mechanisms of setting fibres. Diffusion of gases through films and relating of the diffusion coefficients with film structure. Diffusion of dyes into films (VLF) equation, high tenacity of fibres polyethylene fibres modacrylics, fluorine containing fibres, Nomex (Kelvar).

54. ICH 302: CHEMISTRY OF ELASTOMERS (1,0,1)

Raw material sources, manufacture, cross-linking and properties of the following elastomers: polyisoprene (natural and synthetic); Butadiene: SBR; thermoplastic elastomer, Ethylene propylene rubber, polyisobutylene: butyl rubber, Neoprene: Acrylic elastomers, nitrile rubbers, Fluorinated rubbers, chlorosulphonated polyethylene rubber, polyether rubber.

55. CHM 401: HETEROCYCLIC CHEMISTRY (2,0,1)

Survey of nomenclature of three to eight – membered oxygen, nitrogen and sulphur heterocylic compounds. Synthesis and properties of five members, six – membered and fused rings with one heteroatom. Diazoles, thiazoles, diazines and fused rings with more than one heteroatom, chemistry and uses. The synthetic and mechanistic aspect of fused heterocyclic systems particularly quinolines, isoquinolines, benzofurans, benzothiophenes, indoles, penzoprylium salts, chroumarins and chromones. Application of heterocyclic systems in drug synthesis. **Pre-requisite: CHM 305**

56. CHM 403: STRUCTURE & CO-ORDINATION CHEMISTRY (2,0,0)

Wemer complexes and co-ordination theory, nomenclature of inorganic complexes, Co-ordination numbers and geometries; sterechemistry. Theoretical aspects of co-ordination compounds – valences shell electron pair repulsion theory, application of bonding theories to predict the geometry. Colour and magnetism of complexes. Stability of complex compounds. Thermodynamics and kinetics stability of complexes. Mechanism of reaction and preparation of co-ordination compounds. Metal carbonyls and complexes formed between metal and unsaturated hydrocarbons. **Pre-requisite: CHM 303**

57. CHM 405: QUANTUM CHEMISTRY   (2,0,0)

Postulates of Quantum mechanics, operators, angular momentum solution of the hydrogen atom problem. Theory of atomic spectra, self consistent field theory, computation aspects. Perturbation and variation methods. **Pre-requisite: Chm 312**

58. CHM 407: MOLECULAR SPECTROSCOPY (2,0,0)

Theory of microwave, infrared, Raman, ultraviolet and visible, nuclear magnetic resonance and mass spectroscopies. Qualitative and quantitative techniques in organic spectroscopy, including double resonance and variable temperature techniques.

Pre-requisite: CHM 308

59. CHM 409: ANALYTICAL CHEMISTRY II (2,0,1)

Atomic Absorption and emission spectroscopy, classical methods in food characterization, thermo-chemical methods, electrophoretic techniques, electro analytical methods, nuclear techniques (radiochemical methods).

Pre-requisite: CHM 307

60. CHM 411: ORGANOMETALLIC CHEMISTRY (2,1,0)

Classification of organometallic compounds; Preparation, structure and reactions, including abnormal science of organometallic compounds. Reactions of ionic and radical species generated from organometallics, application, synthetic utility of organometallics. Reaction and structures of organometallic compounds of transition elements and some representative elements. Classification of ligands, electron rule, bonding, preparation of organic transition of compounds. The organic chemistry of ferrocene and related compounds. The role of organometallic compounds in some catalytic reaction. **Pre-requisites: CHM 202, CHM 303**

61. CHM 413: PHOTOCHEMISTRY & PERICYCLIC REACTIONS (2,0.0)

Fundamental and principles of photochemistry, photochemical kinetics, mechanism of oxidative degradation of polymers and unsaturated organic compounds, photodegradation of some selected polymers. Photochemistry of some common solvents, photochemical synthesis, in chemical and biochemical systems Reactions of species produced photochemically. Sensitization and quenching. Conventional photolysis procedure. Flash photolysis. Photosynthesis, Chemiluminescence, vision and the photographic process. Photo-fragmentation, oxidation, reduction, rearrangement, pericyclic reactions and molecular orbital symmetry. Energy levels. Absorption and emission of light. Interaction of radiation with matter. Spin conservation rules. Electronic

excitation: Excitation of atoms in the phase, excitation of diatomic molecules, polyatomic molecules, complex polyatomic molecules and other complexes. Selection rules, deactivation routes, energy transfer, simple reactions of stable singlet and triplet states. **Pre-requisite CHM 305**

62.   CHM 417: MACROMOLECULAR CHEMISTRY   (2,1,0)

Classification of macromolecules; polymers and copolymers as natural, modified or synthetic substances. Polymer formation processes; methods, kinetic mechanisms. The characterization of macromolecules; molar mass, molecular size and shapes, stereochemistry. Morphology, Crystallinity, orientation and methods of determination. Structural classification in natural macromolecules. Bulk structure, amorphous, glassy and rubbery states. Inter-relation of structure and properties. Kinetics and mechanism of degradation, inhibitors and retarders. Biopolymers, inorganic macromolecules; condensed oxyanion structures, silicates. Solution properties of macromolecules. Thermodynamics of polymers solution.

63.   ICH 401: PROCESS TECHNOLOGY I   (2,0,0)

Energy and material balance in ideal tubular flow rectors. Energy and materials balance in continuous stirred flow reactors comparison of Batch and continuous processes, multiple reactor systems, and chemical reactions with complex kinetic model such as parallel reactions, enthalpy balance and heat transfer in constant stirred tank reactor (CSTR) and tubular reactors. Separation processes: - evaporation distillation and solvent extraction in the chemical industry.

64.   ICH 403: INTRODUCTION TO MATERIAL SCIENCE AND MINERALS (2,0,0)

Classification and properties of industrial materials. Types of bonding and its influence on both structure and properties of materials. Manufacture and properties of solid solutions (alloys). Structure of crystalline materials, coordination number, Crystallography. Stress-strain relationship in materials, Crystal growth and imperfections (defects). Material transformation- deformation strengthening, electroplating and corrosion. Common minerals in the earth's crust; their occurrences and uses, chemical and physical properties of minerals in relation to their crystal chemistry and chemical constitution. Influence of mineral chemistry on beneficiation. Important world sources of economic minerals, with special emphasis on minerals resources of Africa. **Pre-requisite: CHM 202**

65. ICH 405: SPECIALIZED AND CONDUCTIVE POLYMERS (2, 0, 0)

Nature of polymer nomenclature. Conducting polymers. Chemical structures of some important conjugated polymers. Electrical conducting in polymer materials. Polyacetylene materials, polyphenelene materials, polypyrole materials, polythiophene materials, polyaniline materials, polyphenylene vinylerene. Doping process in conducting polymer preparation. P and N type doping. Common acceptors or donors e.g. bromine, iodine, AsF_5, Arsenic pentachloride, SbF_5, $FeCl_3$. Common donors like alkaline metals, chemistry of doping of conducting polymers. Highly doped conjugated polymers. Electrochemical energy storage as a result of doping. Special optical properties of conjugated polymers. Magnetic properties of conjugated polymers, material processing of conjugated polymers. Conjugated polymers as one dimensional metals. Conjugated polymers as disordered metals amorphous semiconductors.

66. CHM 501: CHEMISTRY OF CARBOHYDRATES AND BIOMOLECULES (2,0,0)

Classification, structure, nomenclature and reactions of carbohydrates. Preparations and reactions. Configurations, epimerization and stereoisomerism as applied to carbohydrates. Cyclic structures of sugars and sugar derivatives. Occurrence and structure of pophyrine structure and chemistry of nucleosides, nucleotides and nucleic acids. Synthesis and biosynthesis of peptides. **Pre-requisites: CHM 305 and CHM 401**

67. CHM 503: SYNTHETIC METHOD IN ORGANIC CHEMISTRY 1   (2,0,1)

Synthetic philosophy; Strategic design rules in organic synthesis (disconnection approach), synthons and synthetic equivalents. Functional group interconversions in aliphatic and aromatic substrates; Reduction methods-catalytic hydrogenation, reduction with boron and aluminium hydrides and their analogues and derivatives, metal reductions, selective reduction in polyfunctional compounds. Oxidation methods-epoxidation, hydration and hydroxylation of alkenes, oxidative cleavage of glycols, hydroboration oxidation to ketones. Carboxylation reactions and protonolysis; phosphorus halides and their applications, enamines synthesis and applications, formation of polycyclic compounds, aldol type reactions and reactions of iminium salts with nucleophiles. Use of protecting, activating and directing groups. Synthesis of complex molecules and molecular self assembly in synthesis. Pericyclic reactions

Pre-requisite: CHM 305

68. CHM 505 GROUP THEORY AND SYMMETRY (2,0,0)

Review of molecular symmetry operations. Definition of groups. Molecular Symmetry groups. Introduction to the mathematical structure of groups. Group representations. Detailed study of groups Cn, Dn, C¥v and full rotation group. Applications. General symmetry applications. Symmetry of crystal lattices, Block orbitals for infinite system.

69. CHM 507: CHEMISTRY OF LANTHANIDES AND ACTINIDES (2,1,0)

Occurrence and electronic configurations of actinides in comparison with lanthanides, oxidation states, size relationship, absorption spectra and magnetic properties and colour, stereochemistry, methods for the recovery and separation of the elements. The chemistry and uses Lanthanides and Actinides. **Pre – requisite: CHM 303**

70. CHM 509: STATISTICAL MECHANICS AND THERMODYNAMICS (2,1,0)

Maxwell-Boltzmann statistics; calculation of thermodynamic properties; partition functions, heat capacities; entropy; equilibrium constants; use of spectroscopic data; transition state theory; quantum effects.

Microstates and randomness; ensembles; probability and distribution functions; the Boltzmann distribution; statistical thermodynamics of gases; the calculation of thermodynamic equilibrium constant from partition function; statistical thermodynamics of monatomic solids; introduction of Fermi-Dirac and Dose-Einstein

71. CHM 511: RESEARCH PROJECT (0,0,3)

Students are attached to their project supervisors for research on selected topics.

Pre-requisite: Year V registration

72. ICH 501: CHEMISTRY OF SOAPS, DETERGENTS AND COSMETICS (1,0,1)

Detergency process and mechanism, manufacturing process for soaps and detergents, synthetic surfactants (polar and non-polar) and their products. Experiments on the determination of micelle concentration, and soap preparation coupled with industrial visitation to soap manufacturing industries. Inorganic qualitative and quantitative analysis, colourimetry. Commercial Surfactants, Raw Materials and Local Sources,

Formation Parameters- Raw Materials Cost, Production Cost, Profit and Loss Calculation. Hands-on manufacturing of the following consumer products: Liquid Soap, Liquid Detergent, Hair Shampoo, Car Wash (containing wax anti-corrosion agent); Solid Soap: Bar Soap and Tablet Soap, Body Cream and Lotion. Pre-**requisite: CHM 304**

73.   ICH 503: MINERAL PROCESSING (2,0,1)

Mineral processing – Physical processing of minerals and their classification. Mineral concentration- gravity concentration, Liquid - solid separation of aggregation, dense medium separation, communition, particles size analysis, Chemical processing of minerals - Unit operations, hydrometallurgical processes. Halogen processes and metallurgy: high temperature processes and metallurgical thermochemistry. Froth flotation of metallic ores, emulsion flotation of non-metallic ores. Mineral process design and metallurgical accounting and control.

74.   ICH 511: NUCLEAR AND RADIATION CHEMISTRY   (2,0,0)

Revision of proton-neutron nucleus, neutron excess, she'll model and nuclear spin. Alpha, migration, position, electron capture, gamma and internal conversion decay modes of the properties of particles produced - annihilation, range, shielding etc. Detection systems, solid and liquid scintillation counting. Quenching and channels ratio correction. Natural radiations, Nuclear instability and radioactivity. Induced radioactivity - mass and energy balance including recoil. Building energy. Fission and fussion. kinetics of decay, half-life and decay curve, Health effects, permissible dose level, risk estimates. Types of nuclear reactions, interaction of radiations with matter, radiation effect in solid inorganic compounds, Aqueous and non-aqueous radiolysis of polymers, organic compounds and selected food items. Trends in radiation dosimetry for industrial radiation processing. Radiation detector and measurements, Reactor types classified by fuel, moderator coolant. Introduction to activation analysis. The use of isotopes in reaction mechanism and analysis. Methods of obtaining analytically pure samples (purification of isotopes) for use as tracers and in nuclear studies. Tracers in chemical applications and Mossbauer spectroscopy, sources of nuclear bombarding particles. **Pre requisite CHM 101, CHM 303**

75.   ICH 507 – CHEMISTRY OF PAINTS & ADHESIVES

Paints: Basic principles, pigmentation, solvent types and properties, paints additive and cure of paint defects. Oil and alkyd paints, epoxy resin paints. Polyurethane and unsaturated polyurethane finishes. Mechanism of protection by organic coatings,

Adhesives, Theories of adhesives and wetting of surface classification of adhesives and adhesive materials, analysis of adhesives. **Pre-requisites: CHM 306, CHM 409**

76. ICH 509: RESEARCH PROJECT (0,0,3)

Students are attached to their project supervisors for research into selected topics of interest to the community and of academic interest. **Pre-requisite: Year V registration.**

77.   CHM 502: ORGANIC SYNTHETSIS II (2,0,0)

Formation of carbon-carbon bonds via the reaction of nucleophiles with electrophiles, cycloadditions, combination of radical centres and rearrangement reactions. Regioselective and stereo selective syntheses. **Pre-requisite: CHM 305**

78.   CHM 504: INORGANIC REACTION MECHANISMS (2,0,0)

Study of the kinetic and mechanisms of octahedral and square planar substitution reactions. Application of Crystal field theory to explain reaction mechanism. Stereochemistry of substitution reactions. Electron – transfer reactions, group theory and symmetry.

 Pre-requisite: CHM 308, CHM 403

79.   CHM 508: NATURAL PRODUCT CHEMISTRY (2,0,0)

General methods of isolation, separation, purification and structural determination of natural products. Classifications and biogenesis. sources classification, Chemistry and importance of lipids, terpenes and terpenoids, steroids and steroidal hormones, alkaloids, antibiotics, flavonoids. Prostaglandins, carotenes, pheromones and chlorophylls. Other natural products of pharmaceutical importance. Cholesteryl benzoate, liquid crystals and digital display in computer screens, etc. **Pre-requisite: CHM 305**

80.   CHM 510: RESEARCH PROJECT (0,0,3)

Students are attached to their project supervisors in continuation of their research project.

Pre-requisite: Year V registration

81.   PEN 503: SMALL/SCALE BUSSINESS MANAGEMENT (2,1,0).

The small business/entrepreneurship development in Nigerian society, starting or   buying a new business, sources of funds for the small business, small business location, personnel functions of small business, recording keeping system for the   small scale business, common small business expenses, profit planning and cash management, standard accounting principle for small and medium scale enterprises.   Feasibility studies for establishing a small scale business.

82.   ICH 502:   PROCESS TECHNOLOGY II   (2,0,0)

Process Development, chemical kinetics in Reactor Design. Process control by mass and energy balance. Quality control in chemical industry. Setting of standards of quality parameters. Safety in the chemical industry including consumer safety. Criteria for sample rejection or acceptance. Tolerance charts. Legal responsibility and the Nigerian Standards organization. **Pre-requisite ICH 403**

83. ICH 504: ENVIRONMENTAL CHEMISTRY (2,0,0)

Concepts of elementary cycles. Characteristics of the atmosphere. Source, type and effects of environmental pollution. Waste water treatment. Composition of domestic/industrial wastes and waste management. Water chemistry and analytical, chemical and physical instrumentation in environmental sciences. Design of anaerobic contact processes, Aeration process design, sludge modification and digestion, physical water Treatment-Screening filtration, sedimentation and flotation, chemical water treatment for organic and inorganic pollutants, wastewater from chemical and food industries. Air Pollution sources, types and effect, modern analytical techniques for pollution detection and analysis. Introduction to Environmental Impact Assessment. Green Chemistry: 12 principles. Biodegradable macromolecules including detergents. **Pre-requisites: ICH 403**

84.   ICH 506: INDUSTRIAL MINERALS AND SOLID FOSSIL FUELS (2,0,0)

Winning, properties and application of some industrial minerals (appetite, barites, salts, fluorspar, clays, calcite and aragonite; industrial diamonds). Coal and Coal Technology: origin, composition, classification, preparation, gasification,and reformation. mineral chemistry, industrial rocks and coal deposits of Nigeria.   **Pre-requisite: Year V registration**

85.   ICH 508: INSTRUMENTAL METHODS OF ANALYSIS (2,0,1)

Components of analytical instruments. Choice of Instrument of analysis. Instrumental Noise and methods of Noise reduction. Accuracy and precision of Instruments. Instrumentation for trace analysis, Molecular luminescence methods of analysis, electron spectroscopy for chemical analysis (ESCA), and X-ray methods.

Pre-requisite CHM 307, 409

86.   ICH 510:   INDUSTRIAL CHEMICALS AND ALLIED PRODUCTS (2,0,0)

Economics of chemical manufacture: Materials Resources and costs Types of costs, factors affecting costs. Yields and conversion into useful products. Raw materials for organic chemical manufacture potential raw materials, vegetable raw materials, petroleum and natural gas. Coal as raw material. Building blocks of the chemical industry-ethylene, propylene the C_4 and aromatic hydrocarbons. The vinyl group as a building block. Plastics and synthetic rubbers unit processes in organic chemical processing.

Pre-requisite. Year V registration

87.   ICH 513: ELECTROCHEMICAL TECHNOLOGY (2,0,0)

Standard state and the Nernst equation. Applications of e.m.f measurements (excluding thermodynamic relationships). Potentiometric titration including measurement of pH. Redox reactions. The electrical double layer and its applications. Fuel cells, electro catalysis, porous electrodes, Primary cells: Leclanche and mercury, Secondary cells: Lead-acid, nickel, cadmium and new developments, electrodeposition: metal finishing, metal extraction and electroforming, electro synthesis, Pollution control cyanide break down and metal removal, corrosion. **Pre-requisite: CHM 306.**

88.   ICH 514:   GEOCHEMISTRY   (2,0,0)

Elements and their abundances. Geochemical classification of elements. Some aspects of isotope geochemistry. Introductory mineralogy and mode of occurrence of selected ores with reference to Nigeria. Physical and Chemical analysis of ore. Some aspects of organic geochemistry. Mineral processing; practice of crushing, sizing and concentration of mine products. Concept of surface chemistry; Mineral and gases, Mineral in water, Mineral- air-water systems. Mineral dispersions in water colloidal stability, coagulation and flocculation.

89.   ICH 512: RESEARCH PROJECT (0,0,3)

Students are attached to their project supervisors in continuation of their research work.

Pre-requisite: ICH 509 registration.

90.   PTE 506: TECHNOLOGY OF COLOURATION AND FINISHING OF   POLYMERICS AND TEXTILES (2,1,0)

Introduction to theory of dyeing thermodynamics, kinetics and dye polymer interactions role of fibre structure in dyeing. Dyeing of man-made fibres, blends; recent advances in technology of dyeing machines used for printing. Dyeing ageing, steaming, faults in printing, transfer printing. Sauforization, easy care finishes, wash-wear/durable press cellulosic; rot and mildew proofing water proofing and water repellent finishes. Flame proofing, setting of synthetic fibres, systems for fabric casting and lamination. (polymer stereochemistry and coordination polymerization) fine structure of cotton and rayons, theories of fibre structure, moisture absorption by films and fibres, heat of sorption and melting.   **Pre-requisites: PTE 316.**

91. PTE 523: PULP AND PAPER TECHNOLOGY (2,1,0)

Introduction to wood-polymer principles; emphasis on chemical and physico-chemical properties of wood based on its polymeric chemical structure. Wood and pulping chemistry, processes involved in paper manufacture, finishing and adhesive systems widely used in wood products manufacturing. Analysis and testing.