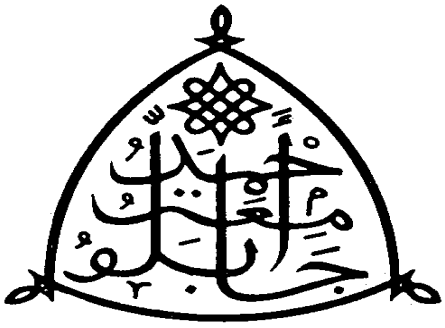

AHMADU BELLO UNIVERSITY, ZARIA, NIGERIA.

DEPARTMENT OF MINING ENGINEERING

FACULTY OF ENGINEERING

WELCOME

The Department of Mining Engineering, Ahmadu Bello University, is established to be one of its kinds in the country in terms of imparting quality Education to students both locally and internationally. The Department has undoubtedly recorded tremendous achievements since its inception in May, 2016. The strategic location of the Department, cosmopolitan nature of its staff and students, and a robust academic culture are sources of its strength. The challenges facing the Department are indeed enormous.

We extend gratitude of the Department to all those who identified with our course. We also take great pride and pleasure in the many and varied achievements of our students through their studies, extra-curricular activities, performance beyond the University, especially via public service and altruistic activities.

Thank you.

Head of Department.

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1. INTRODUCTION

In the developing countries of the world, strong emphasis is being laid on the transfer of technology from the technologically advanced countries. Different approaches have been adopted by the countries concerned in this process and naturally, varying degrees of success have been achieved. The greatest obstacles in the technological developments of these countries are principally political instability and lack of the necessary human and material resources.

In Nigeria, the foundation for a sound political setup is laid, and adequate materials and human resources are available and ready to be tapped. What we lack is the development and execution of a technical blueprint for achieving the goal. In this instance, the technological development of Nigeria is now being moved from the state of complete reliance on the advanced countries of the world for the production of even our food to a state of self-sufficiency. This is seen in the Government's emphasis on food, shelter and education. Industries are geared to the supply of the necessary materials for a rapid industrialization and subsequent production of these needs. It is therefore not surprising to note the emphasis of the Federal Government on and its commitments to the building of iron and steel plants in many parts of the country.

The training of the necessary manpower is also vigorously being pursued. The technicians are presently being trained in the numerous colleges of technology all over the country for the purpose of operating and maintaining the industrial processes and equipment. As a step further, the engineers are being trained to design and produce the specific equipment for our industries. The extraction of engineering materials for industrial applications is a logical development for the growth of technology in the country, and this is the basis for the training of Mining engineers. The mining engineers dig up the metal-bearing earth (ores) from the ground while the minerals engineers extract the metals and metallurgical engineers manufacture alloys for machine components and fabrication. The training of the mining and minerals engineer in Ahmadu Bello University, Zaria Nigeria has been developed to cover this entire spectrum of activities.

1.1. MISSION AND VISION STATEMENTS

i. Mission of the University:

To advance the frontiers of learning and break new grounds, through teaching, research and dissemination of knowledge of the highest quality; to establish and foster national and international integration, development and the

promotion of African traditions and cultures; to produce high-level human power and enhance capacity-building through retaining, in order to meet the needs and challenges of the catchment area, Nigeria and the rest of the world.

ii. Mission of the Programme:

To produce Mining Engineering graduates of high intellectual standing, to help in meeting the technological aspiration of Nigeria.

iii. Vision of the University

Ahmadu Bello University shall be a world class university comparable to any other, engaged in imparting contemporary knowledge, using high quality facilities and multidisciplinary approaches, to men and women of all races, as well as generating new ideas and intellectual practices relevant to the needs of its immediate community, Nigeria and the world at large.

1.2.VALUES

Good Virtues, Hard-work and Dedication.

1.3. PHILOSOPHY

The philosophy of the programme is to train mining engineers equipped with appropriate knowledge and skills required for effective operation and management of the minerals, oil and gas industry, a key sector for rapid diversification of the Nigerian economy.

1.4. AIMS/OBJECTIVES

In line with the National Policy on Education and within the bounds of the mission of the university, the objectives of the programme are to:

(a) train mining engineers for the extractive industry (Minerals, oil and gas);

(b) provide a broad-based training in Mining Engineering such that the graduates of the programme can perform effectively in prospecting, mining, processing and marketing of minerals, oil and gas; and

(c) produce graduates that can undertake teaching and research in higher institution and consulting services in the extractive industry.

1.5. RATIONALE/JUSTIFICATION

Nigeria is heavily endowed with solid mineral, with a sizeable number found in economical quantities. The exploration and exploitation of these minerals is largely at the artisanal level, hence optimal exploitation of these abundant

minerals has not been attained.
The dearth of skilled manpower, among other factors, has affected the growth of the sector. The renewed Government vigor of divesting from Petroleum to solid Minerals can only come into fruition if skilled manpower is/are available and allowed to be the key players/stakeholders in the sector.
If the Mineral potential of the Nation is optimally tapped, it will significantly improve the Gross Domestic Product (GDP) of the country, and potentially create wealth and employment for the teeming populace, most especially the vulnerable; under 30. This will certainly improve the socio-economic wellbeing of the populace and impact positively on security.

2. ENTRY REQUIREMENT

2.1. Admission

In order to be eligible for admission into the undergraduate (B.Eng. degree)

Mining Engineering Programme, a candidate, in addition to satisfying the University general entry requirements, must obtain at least credit passes in each of English, Mathematics, Physics and Chemistry as well as any other science subjects at the Senior Secondary School Certificate Examinations or its equivalent.
The current minimum requirements for admission into 100 level (UTME entry) and 200 level (Direct entry) in the Department of Mining Engineering are as follows:

2.1.1. Joint Matriculation Examination (JME) Entry:

Applicants seeking JME entry must:

i. Have attained the age of sixteen years on the first day of October in the year of their candidature.
ii. Possess the School Certificate (SC) or the General Certificate of Education, Ordinary Level (GCE "O" Level) with passes at credit level in at least five subjects obtained at not more than two sittings and at least a credit in English Language. The five subjects should include Mathematics, Chemistry and Physics. UTME subjects are: Mathematics, Chemistry and Physics.

2.1.2. Direct Entry:

Applicants seeking direct entry should have:

i. Five SC or GCE O' level credit passes including English, Mathematics, Chemistry, Physics and any other science subject.
ii. GCE 'A' level or IJMB passes or equivalent "A" level passes in Mathematics, Chemistry and Physics.
iii. Candidates with Higher National Diploma (HND) may also be admitted into the 200 level with lower credit or 300 level with distinction or upper credit in Mining and Minerals Engineering. Ordinary National Diploma (OND) candidates possessing overall upper credit pass with three distinctions passes in core courses of Mining including Mathematics may be admitted into 200 level. In special cases, candidates with high grades in 'O' levels plus relevant advanced professional qualification may be accepted. Such cases will be considered individually by the Faculty Board of Engineering and Senate.

3. THE COURSE STRUCTURE

3.2. Categories of Course

The courses within the Faculty fall under the following headings:

a. Core courses
b. Cognate courses

c. Restricted electives
d. Unrestricted electives
e. Pre-requisite courses

3.1.1. Core courses

i. They are central to the degree programme in view.
ii. They are normally offered by the Department offering the degree
iii. They constitute not less than 60% (i.e. 90 credit units) of all the course units that the student must take to complete the requirements for a degree in a given Department.

3.10.2. Cognate Courses

i. Cognate courses are prescribed course units from related fields which are indispensable for an understanding and appreciation of the student's major field.

3.10.3. Restricted Electives

i. These are optional courses i.e. a set of required courses from which a student is made to select one or more courses as the case may be.
ii. They are normally offered by OTHER Departments within the same Faculty.
iii. They constitute about 15% (i.e. 23 credit units) of all the course units required for the degree before graduating.

3.10.4. Unrestricted Electives

i. They are courses which are opted for by the student in accordance with his or her own interest.
ii. They are normally offered from OUTSIDE the Faculty
iii. The status of the unrestricted elective courses taken by a student shall be determined by the Faculty
iv. They constitute about 5% (i.e. 8 credit units) of all the credit units of the required course units for the degree in view.

The lists of the courses specified for each level are organized on the course credit system per semester. These lists for each level are shown in tables below.

3.2. Course Content

The university has adopted the approved BMAS and included additional courses to approved BMAS; given below is the course content for the Mining

Engineering programme in line with the approved NUC BMAS:

3.2.1. List of Courses to be offered in First Semester 100 Level

S/No	Course Code	Course Description	Credit Unit
1	MATH 101	Set Theory and Number System	2
2	MATH 103	Trigonometry and Co-ordinate Geometry	2
3	MATH 105	Differential and Integral Calculus	2
4	COSC 101	Programming in Basic	2
5	PHYS 111	Mechanics	2
6	PHYS 131	Heat and Properties of Matter	2
7	PHYS 161	General Physics Practical I	1
8	CHEM 101	Introduction to General Chemistry	2
9	CHEM 121	Introduction to Inorganic Chemistry	2
10	CHEM 191	Introduction to Practical Chemistry I	1
11	ENGG 101	Introduction to Engineering Profession and Institutions	1
12	GENS 101	Nationalism	1
13	GENS 103	English for Communication Skills	2
		Total	**22**

3.2.2. List of Courses to be offered in Second Semester 100 Level

S/No	Course Code	Course Description	Credit Unit
1	CHEM 112	Introduction to Physical Chemistry	2
2	MATH 102	Algebra	2
3	MATH 104	Conic Sections and Application of Calculus	2
4	MATH 106	Vectors and Dynamics	2
5	STAT 102	Introduction to Statistics	2
6	PHYS 122	Electricity, Modular and Magnetic Physics	2
7	PHYS 124	Geometry and Wave Optics	1
8	PHYS 162	General Physics Practical II	1
9	CHEM 132	Introduction to Organic Chemistry	2

10	CHEM 192	Introduction to Practical Chemistry II	1
11	MIEN 102	Introduction to Mining Engineering	1
12	GEOL 102	Introduction to Mineralogy and Petrology	1
13	MIEN 104	Introduction to Geology	1
		Total	**20**

3.2.3. List of Courses to be offered in First Semester 200 Level

S/No	Course Code	Course Description	Credit Unit
1	MATH 241	Calculus	3
2	MATH 243	Methods of Linear Algebra	2
3	EEEN 201	Electrical Circuits and Field Theory	2
4	EEEN 203	Electrical Machine, Power and Installation	2
5	CVEN 201	Introduction to Structural Analysis	2
6	MEEN 201	Engineering Graphics	2
7	MMEN 201	Fundamentals of Material Science	2
8	WREN 201	Fluid Mechanics I	2
9	GENS 201	Moral Philosophy	1
10	GEOL 203	Crystallography	2
11	GEOL 205	Geology Field Work I	1
		Total	**21**

3.2.4. List of Courses to be offered in Second Semester 200 Level

S/No	Course Code	Course Description	Credit Unit
1	CHEN 202	Introduction to Engineering Management	1
2	MEEN 202	Engineering Drawing	2
3	MEEN 204	Strength of Materials I	2
4	MEEN 206	Fundamental of Dynamics	2
5	MEEN 208	Basic Thermodynamics	2
6	EEEN 202	Electronics Measurement and Transducers	2
7	MATH 242	Calculus	2
8	MATH 244	Methods of Linear Algebra II	3
9	MIEN 222	Industrial Applications of Minerals	1

10	GEOL 202	Elements of Structural Geology	2
		Total	**19**

3.2.5. List of Courses to be offered in First Semester 300 Level

S/No	Course Code	Course Description	Credit Unit
1	MIEN 311	Mining Engineering I	2
2	MIEN 321	Mineral Processing I	2
3	MIEN 313	Engineering Surveying	3
4	MIEN 315	Strength of Mine Materials	2
5	MIEN 317	Mine Geometry	2
6	MIEN 391	Laboratory Course Work 1	1
7	GEOL 315	Geophysics I	2
8	GENS 301	Entrepreneurship	2
9	MEEN 301	Machine Design	2
10	MATH 341	Differential Equations and Transforms	2
11	QTYS 309	Development Economics	1
		Total	**21**

3.2.6. List of Courses to be offered in Second Semester 300 Level

S/No	Course Code	Course Description	Credit Unit
1	MIEN 310	Mine Surveying	3
2	MIEN 312	Drilling and Blasting	3
3	MIEN 314	Rock Mechanics	3
4	MIEN 322	Mineral Analysis	2
5	MIEN 324	Mineral Processing II	2
6	MIEN 326	Artisanal and Small Scale Mining and Mineral Processing	2
7	GEOL 414	Geology and Mineral Resources of Nigeria	2
8	MIEN 328	Mineral Exploration Methods	2
9	MIEN 316	Mine Camp (Drilling and Blasting)	3
		Total	**22**

3.2.7. List of Courses to be offered in First Semester 400 Level

S/No	Course Code	Course Description	Credit Unit

1	MIEN 411	Surface Mining	3
2	MIEN 413	Oil and Gas Well Drilling	2
3	MIEN 415	Mine Ventilation	3
4	MIEN 421	Precious Stone Technology	2
5	MIEN 423	Mineral Economics	2
6	MIEN 425	Technical Report Writing	1
7	MIEN 491	Laboratory Course Work III	1
8	QTYS 421	Laws for Engineers	1
9	STAT 443	Experimental Design, Quality and Control	2
10	GEOL 405	Hydrogeology	2
11	GEOL 417	Petroleum Geology	2
		Total	**21**

3.2.8. List of Courses to be offered Second Semester 400 Level

S/No	Course Code	Course Description	Credit Unit
1	MIME 497	Student Industrial Work Experience Scheme (SIWES)	6

3.2.9. List of Courses to be offered in First Semester 500 Level

S/No	Course Code	Course Description	Credit Unit
1	MIEN 511	Underground Mining	3
2	MIEN 513	Mine and Mineral Processing Equipment and Machinery	2
3	MIEN 515	Mine Management	2
4	MIEN 517	Mine Design	2
5	MEEN 503	Production Management 1	1
6	MIEN 519	Petroleum Reservoir Engineering	3
7	MIEN 527	Extractive Metallurgy	2
8	MIEN 599	Final Year Project I	3
		Total	**18**

3.2.10. List of Courses to be offered In Second Semester 500 Level

S/No	Course Code	Course Description	Credit Unit

1	MIEN 522	Technology Policy and Development	2
2	MIEN 512	Materials Handling	2
3	MIEN 514	Mine Valuation	2
4	MIEN 516	Health and Safety in Mining Industry	3
5	MIEN 524	Environmental Impact Assessment of Mining Operations	3
6	MIEN 526	Mining Law	2
7	MIEN 528	Software application in Mining and Mineral Processing	2
8	MEEN 502	Production Management II	1
9	MIEN 599	Final Year Project II	3
		Total	**20**

COURSE DESCRIPTION

100 LEVEL

MATH 101: SETS AND NUMBER SYSTEMS **(2 Credit Units)**

Elements of set, universal set, empty set, etc Cartesian product; Finite and infinite sets; Venn diagram; Cardinal number, power set, Disjoint set, etc. Relation, mapping and functions; Binary operation, Structure of number system.

MATH 103: TRIGONOMETRY AND COORDINATE GEOMETRY (**2 Credit Units)**

The trigonometry functions, Special angles, inverse trig functions, identities. Additions formulae for trig functions, Trigonometric functions of multiple and half angles, the Factor formulae. The sine rule, heights and distances. Systems of coordinates; Cartesian coordinates. Lengths parallel to the axis, Gradients, and Division of a line in a given ratio. Equation of a straight line: Gradient and one point form, General equation, the Point of intersection, Line through the mid points of two lines, parallelism, etc. The Circle: Equation, etc.

MATH 105: DIFFERENTIAL AND INTEGRAL CALCULUS **(2 Credit Units)**

Functions: Definition, Even and odd functions, Period functions, transcendental functions, Polynomial functions. Limits and continuity of functions. Graph of a function. Differentiation; Derivative, Differentiable functions. Algebraic properties of derivatives; Sum, Difference, Product Quotient and chain rules. Higher order differentiation. Integration; Definite

integrals, Techniques of integration. Partial fractions.

COSC 101: PROGRAMMING IN BASIC **(2 Credit Unit)**
Basic computer concepts; problems solving on the computer; Characters, Constants and Variables. Arithmetic expressions; BASIC Statements; BASIC Function; The PRINT statement; Entering data; Transfer of control statements; Repeating or looping; Subscripted variables of the DIM statement; Subprograms; Matrix commands.

PHYS 111: MECHANICS (**2 Credit Units)**
Units and Dimensions. Vector and Scalar quantities. Linear Motion, concept of force. Work, energy and power, Circular motion, Simple harmonic motion. Motion of a rigid body. Static, Gravitation.

PHYS 131: HEAT AND PROPERTIES OF MATTER (**2 Credit Units)**
Structure of solids, liquids and gases. Kinetic theory of ideal gases Elasticity, Surface tension. Fluids in motion, Solid friction and viscosity, Heat and temperature, Calorimetric. Thermal extension. Transfer of heat.

PHYS 161/162: GENERAL PHYSICS PRACTICAL I/II **(1 Credit Unit each)**
The introductory courses emphasizes quantitative measurements, treatment of measurement errors and graphical analysis. A variety experimental techniques will be employed. Simple experiment in mechanics, properties of matter, heat, light, and electricity are emphasized, which are relevant to the course PHYS 131, 122 and 124.

CHEM 121: INTRODUCTION TO INORGANIC CHEMISTRY (**2 Credit Units)**
Periodic table (gradation of physical and chemical properties within the table, the first transition elements series, comparison of chemistry of the elements of periods II and III); transition metal complexes (nomenclatures, isomerism and hybridization involving orbital).

CHEM 191: INTRODUCTORY PRACTICAL CHEMISTRY I (**1 Credit Unit)**
Basic apparatus; terminologies; safety regulations; basic working skills in the chemical laboratory; acid-base titration; redo titration; weighing and gravimetric analysis.

ENGG 101: ENGINEERING PROFESSION AND INSTITUTIONS (**1 Credit Unit)**
Development of Professional engineering: History of technology and its effect on society. The engineering institutions, their objective all functions. Data measurement, representation and interpretation, report writing and oral representation of information introduction to Economic; Elementary economic concepts; evolution of economic activity; characteristics of modern economic systems.

GENS 101: NATIONALISM **(1 Credit Unit)**
The concept of a national Nationalism: Concept, Significance and History; Nigeria: Cultural diversity, Unity, Consciousness, Identity, Influence of foreign culture; Patriotism; Concept, Significance, examples, Basic and characteristics of nationalism and patriotic spirit in Nigeria; Approaches to nationalism and patriotism.

GENS 103: ENGLISH AND COMMUNICATION SKILLS (**2 Credit Units)**
Listening-comprehension; Listening for specific information, Words and expressions, Main idea. Note taking from lectures; Listening for critical analysis; Reading; Skimming and scanning; Reading for speed; Intensive reading; Note taking from texts; Summarization and Synthesis of Science and Technology, English for arts and social sciences, English for Administrative and Business Studies; English for Law, English for Medical and Paramedical Science; The peculiarities of the course are those of specific registers and pattern of structural discourse.

CHEM 112: INTRODUCTORY PHYSICAL CHEMISTRY (**2 Credit Units)**
States of matter; kinetic theory, colligative properties; structure of solids; crystal lattice structures; thermochemistry; chemical kinetics of first and second order reactions; chemical equilibrium; Buffer solution; hydrolysis constants and solubility products; and electrochemistry.

MATH 102: ALGEBRA **(2 Credit Units)**
Principles of Mathematics induction: Application to sequences and series. Linear, Quadratic and other Polynomial function; the meaning of /X/. The modulus of real number X Elementary properties of quadratic functions; roots of quadratic equations. Application to symmetric functions, Polynomial functions of 3^{rd} and 4^{th} degrees provided they can be reduced to a quadratic or factorized by the reminder theorem. Theory of indices and Logarithms surds: Solution of simple exponential and Logarithmic equations, change of base;

Partial Fractions: Application to summation of series and integration; Sequences and series: Limits of sequences (Rigorous treatment not required). Convergence of series: Illustration by simple examples of convergence of geometric series and series obtained by the partial fractions and the binomial series; Permutations and Combination: Simple examples. The Binomial Theorem and its proof for a positive integral index. Use of the binomial theorem for any rational index; interval of convergence. Applications to approximations and errors. Series expansions for e^k for all x and ln(1+x) for -1<x<1.

MATH 104: CONIC SECTIONS AND APPLICATIONS OF CALCULUS **(2 Credit Units)**
Parabola. Ellipse. Hyperbola. Rectangular hyperbola: Focus-directrix properties, Cartesian and parametric equations, Applications. Determination of locus of a point. Equations of tangents and normal to the conic section, the derivative as rate of change: Velocity, Acceleration and other rates, Curve sketching: Maxima and errors, Newton's approximation. Applications of integration to area and volume determination. Introduction of differential equations: First order differential equations; existence and uniqueness of the solution.

MATH 106: VECTORS **(2 Credit Units)**
Motion of a vector. Position vector, Modulus of a vector, etc Algebra of vectors; Addition, Parallelogram law, Triangle law, etc Scalar product: Components of a vector as its scalar product with a unit vector in a given direction. Applications to finding the angles between two lines and other geometrical applications.

STAT 102: INTRODUCTION TO STATISTICS (**2 Credit Units)**
Stem and leaf charts; frequency distribution tables; Graphical displays, Measures of central tendency and dispersion. Frequency distribution. Discrete sample space, events; probability. Random variables. Binomial, Poisson and Normal distributions. Bivariate data. Correlation.

PHYS 122: ELECTRICITY, MAGNETISM AND MODERN PHHYSICS
(**2 Credit Units)**
Electrostatics; Capacitance; Current Electricity; Magnetic force; Magnetic effects of currents; Electromagnetic induction; Alternating currents. Modern Physics; electronics.

PHYS 124: GEOMETRIC AND WAVE OPTICS **(1 Credit Units)**
Reflection and refraction; the prism: Lenses and their construction; Spherical mirror; Dispersion and the spectrometer, Optical instruments. Wave nature of light.

CHEM 132: INTRODUCTORY ORGANIC CHEMSITRY **(2 Credit Unit)**
Scope of organic chemistry; types of organic compounds and determination of molecular formulae, alkenes, alkanes, alkynes and simple aromatic compounds; types of organic reactions; phenols; carbonyl compounds; carboxylic acids; and carbohydrates.

CHEM 192: INTRODUCTORY PRACTICAL CHEMSITRY II **(1 Credit Units)**
Qualitative analysis of inorganic anions and cation; Organic qualitative analysis.

GEOL 102: INTRODUCTION TO MINERALOGY AND PETROLOGY **(1 Credit Units)**
Definition of minerals and rocks. Introduction to crystals and crystal systems. Classification of minerals based on composition: Native Elements, Sulphides, Oxides, Carbonates, Sulphates, Phosphates and Silicates etc. The use of physical properties in minerals identification. Classification of rocks based on origin. Modes of occurrence, composition and textures of the major igneous, metamorphic and sedimentary rock types.

MIEN 102: INTRODUCTION TO MINING ENGINEERING **(1 Credit Unit)**
Introduction to Mining: [Meaning of Mining, Importance of Mining, Uses of Minerals, Major Classes of Mining, Technological Development in Mining]. Mining Terminology: [Definition of basic terms used in the mining industry: mineral, mine, ore, gangue, mining engineering, mineral processing, mineral engineering, comminution, concentrate, tailings, prospecting, exploration, exploitation, reclamation e.t.c.]. History of Mining: [General History of Mining, History of Mining in Nigeria, Minerals and their locations in Nigeria]. Positive and Negative Effects of Mining: [Benefits of mining- supply of raw materials, employment generation, revenue generation e.t.c, mineral cycle; environmental degradation, occupational hazards and diseases e.t.c]. Stages in the life of a mine, Role of the Mining Engineer: [Stages of Development in Mining, Duties of the Mining Engineer]. Major Mining Methods: [*Surface Mining*-Mechanical Extraction Methods and Aqueous Extraction Methods;

Underground- Supported Methods, Unsupported Methods, Caving Methods]. Mineral Processing and Extractive Metallurgy: [Definitions of: comminution, concentration, dewatering, pyrometallurgy, hydrometallurgy, electrometallurgy]. Mining and Mineral Processing Equipment: [Surface and underground mining equipment, mineral processing equipment].

MIEN 104: INTRODUCTION TO GEOLOGY **(1 Credit Units)**
Introduction to Geology [Definition and scope of geology, Branches of geology, Importance of geology in everyday life, Importance of geology in the mining industry]. Earth's Internal Structure [Earth's layers (crust, mantle, core), Plate tectonics, Earth's internal processes (convection, continental drift)]. Rocks and Minerals [Rock types (igneous, sedimentary, metamorphic), Mineral properties and identification, Rock cycle and geological processes]. Geological Time Scale [Principles of stratigraphy, Relative and absolute dating methods, Major geological events and eras]. Earth's External Processes [Weathering and erosion, Deposition and sedimentation, Landform development and evolution]. Water and Geology [Hydrologic cycle, Groundwater and surface water, Water quality and management]. Geology and the Environment [Natural hazards (earthquakes, volcanoes, landslides), Environmental impact of human activities, Geology and sustainability,]. Economic Geology [Mineral resources and extraction, Energy resources (fossil fuels, renewable), Geology and economic development]

200 LEVEL:

MATH 241: CALCULUS I **(3 Credit Units)**
Sequences and Functions: Infinite sequences and their limits, a short recollection of elementary functions and their properties, limits and continuity of functions of a single independent variable.
Differential Calculus: Definition of the derivative. Differentiability of a function of one independent variable; geometrical and physical interpretation of the derivative, techniques of differentiation, Rolle's theorem and the mean-value theorem, Taylor and Maclaurin's series expansion, application of differentiation; maxima and minima of function of single independent variable, curve sketching in Cartesian rectangular coordinates, L'Hospital rule for evaluation of limits of functions in the indeterminate forms, tangents and 19ormal, curvature and evolutes of plane curves, Leibniz's formula, for finding the nth differential coefficient of a product of two functions.
Integral calculus: Indefinite integral, techniques of integration – change of variable, integration by parts and reduction formulae, integration of rational

functions (standard integral and methods of partial fractions), the definite integral interpretation and properties; application of integral, average value of a function, finding lengths of area, plane areas, volumes of solids revolution area of surface of revolution, pressure, etc.

MATH 243: METHODS OF LINEAR ALGEBRA I **(2 Credit Units)**
Complex numbers: Addition, multiplication, division, argand diagram, polar representation, DeMoivre's theorem, Vector Algebra: Definition of Vector and Physical examples, addition, multiplication by scalar, scalar and vector products, triple products, components and applications in geometry, Vector Analysis: Cartesian and polar coordinates in two and three dimensions. Vector functions of a real variable, continuity and differentiation, application to curves and surfaces in 3 space equation of straight lines, plane and sphere, tangent and 20ormal to a curve, tangent plant and normal to a surface.

EEEN 201: ELECTRICAL CIRCUITS AND FIELD THEORY (**2 Credit Unit)**
Field Theory: *Electric*: Electric charges, Coulomb's Law, Gauss" Law, Electric field, Electric dipoles, potentials, capacitance, work energy. *Magnetic:* Magnetic forces between current elements, Biot-Savart Law, Ampere's Law, Lenz's Law, Lorentz Law, Motor principle, Generator principle, Work Energy.

EEEN 203: ELECTRICAL MACHINE, POWER AND INSTALLATION (**2 Credit Units)**
Transformers and Rotating Machines: Basic Principles: Induction (Faradays Law), interaction (Biot-Savart Law), and alignment, Generalized Basic Units, Magnetic, electrical, mechanical and thermal. Generalized torque equation of electric machines and simple calculations, transformer, Constructional features, types, connections (including 30phase type and application of various types, (DC Machines: Constructional features, types (separately excited, shunt, series and compound), and application. *Introduction Machines:* Constructional features, types (single phase and 3-phase), types of rotor (squirrel cage and wound or slip-ring) and application. *Synchronous Machines*: constructional features, types (salient or non-salient poles types), and application. Brief Introduction and Application of Special Machines: A.C. commutator machines, general purpose machines, repulsion machine, linear motors, etc.
Electric Power Generation, Transmission and Distribution: Types of Power stations, Power generation and transmission problems (flow diagram

representation from generator to consumer terminals). The synchronous generation and its importance in power generation (from small types) in motor cars to huge types in power stations.
Transmission of electric power: The H.T overhead lines and underground cables (show typical underground cables). The distribution transformers in power distribution and their use in the design of estates a.c. and d.c. supplies. The use of a.c. in preference to d.c. stressing the importance of the transformer. Single and three phase supplies; (delta and star connections); typical 3-phase, 4-wire distribution systems. Two wire services and typical consumer circuits. The meaning of impedance (X), volts (V), power ohms and power factor (PF) in a.c. supply systems.
Wiring System: Supply control and distribution in building including, intakes, diversity, wiring circuits for lightning using loop methods, number of points on one circuit, wiring socket outlets. Conductors and cables including: main parts of cables, types of insulators and the choice of cable sizes in various types of installations. Wiring systems including: Conduct systems, rubber and PVC soothed systems; components and accessories used in wiring systems, ceiling roses, lamp holders, switches, etc.
Safety Precaution Including, the need for safety, the use of circuit breakers, and fuses, and the importance of earthling. Illumination: Principle of illumination, definition of terms and the inverse square law, Glare and its effects. Types of lamps and lamp fittings; Principles of lighting design and illumination requirement for various types of usual tasks.

CVEN 201: FUNDAMENTALS OF STRUCTURAL ANALYSIS (**2 Credit Units)**
Concept of structural analysis, Stability and determinacy of frameworks, Analysis of statistically determinate structures, Bending moment and shear force diagrams for determinate beams. Beam deflection. Framework deflections and strain energy in frames, Suspension cables. Determinate arches, stability of gravity sections.

MEEN 201: ENGINEERING GRAPHICS **(2 Credit Units)**
The principles of engineering drawing, engineering lettering, figures and types of line (BS 308 – 1972, Part 1, 2, 3), dimensioning, useful geometrical constructions, principles of tangency, loci-conk sections (ellipse, hyperbola, parabola); cycloids, epicycloids involutes, helices, orthographic project (1st and 3rd angle orthographic projection).

MMEN 201: FUNDAMENTALS OF MATERIALS SCIENCE (**2 Credit**

Units)
Physical properties of materials: Structure of atoms, bonding forces, structure of matter, including mention of wood, cement and plastic. Electrical properties of materials: electrical properties, conductors, electronic properties, semi and super-conductors, magnetic properties, dielectric properties. Mechanical properties: Elastic plastic deformation of materials, Temperature effects on mechanical properties, Fatigue, Creep, Hardness, Mechanical working. Thermal properties: Thermal capacity, thermal expansion, thermal conductivity, thermo-couple phenomenon, temperature consideration in the choice of materials. Chemical properties of materials: corrosion phenomenon and its prevention. Metallurgy: structure of crystalline materials, solidification, mechanical working, liquid and solid solution, interution to the concepts of phase and solid solutions, introduction to the concept of phase equilibrium, micro and macro-structure of materials. Non-metallic materials: Cement, concrete, wood, Ceramics (Glass, ceramic ware), Plastic (Wood, Rubber, etc) and resin.

WREN 201: FLUID MECHANICS I **(2 Credit Units)**
Properties of Fluid: Pressure, viscosity, surface tension, compressibility etc. Hydrostatics: Variation of pressure with position in a fluid, equilibrium of a fluid of constant density, measurement of pressure, barometer, manometer, the Bourdon gauge, thrust on plane and curved surfaces, buoyancy, stability of floating and submerged bodies.
Principles of Fluid Motion: Continuity, Bernoulli's equation, energy transformation in a constant density fluid, energy correction factor, streamlines, pressure variation perpendicular to streamlines, flow through a sharp edged orifice, pilot tube, venture meter, nozzle and orifice meter, notches and sharp crested weirs.
Momentum Equation: Momentum equation for steady flow, momentum correction factor, application of the momentum equation, force caused by a jet striking a surface, force caused by flow round pipe bend, force at a surface at a nozzle and reaction of a jet under short wheel as an example of a simple hydraulic machine.

GEOL 203: CRYSTALLOGRAPHY **(2 Credit Units)**
Definition of crystal; crystallization. Internal structure of crystals. Relationship between internal order and morphology. Crystallographic axes, crystal systems, geometric operations, symmetry elements, crystal forms, crystal classes. Interfacial angles, parameters, axial ratios and Miller indices. Bravais Law, Steno's Law and Law of Rational Indices. Zones and Zone axes.

Twinning; origin, Laws and importance. Spherical and stereographic projection. Constituents of crystals; isomorphism, polymorphism and pseudomorphic. Graphic representation of composition Variations. Physical properties of minerals and the relationships to composition and internal structure. Physical properties of crystals dependent on heat, electricity, magnetism and radioactivity. Practical identification of crystallographic axes, symmetry elements, forms, zones and zone axes, of common basic crystal systems/classes. Measurement of interfacial angles. Determination of axial ratio and Miller indices. Stereographic projection plotting.

GEOL 205: FIELD GEOLOGY I **(1 Credit Units)**
Field study of weathering, Soil Formation, Erosion and Sedimentation Processes. Examination in the field of igneous and metamorphic rocks, sediment, associated structural and other features including land forms. Preparation of field notes and reports. Use of topographic maps in the field. Geological mapping; techniques at large and small scale. Preparation of simple field geology map (e.g. BZ Water Tower).

CHEN 202: INTRODUCTION TO ENGINEERING MANAGEMENT (**1 Credit Units)**
Introduction (definition, uses and types of organization, need for management, the manager and his functions): planning, decision making, organizing, directing and leadership (motivation, communication and leadership), control.

MEEN 202: ENGINEERING DRAWING **(2 Credit Units)**
Isometric projection; free hand sketching, sections and sectional views, auxiliary projections, interpretation of surfaces, development of surfaces, screw threaded and threaded screwed fastenings, conventional representation on the threaded elements on drawing.

MEEN 204: STRENGHT OF MATERIALS **(2 Credit Units)**
Direct stress and strain: tension, compression. Hook's law elastic constants, strain energy, impact load, thermal stress. Geometrical properties of areas: centroid, first and second moments of area, parallel axis theorem, product moment of area, cross sections having and not having axes of symmetry. Simple theory of bending: Classification, bending moment and shear force diagrams, relations between bending moments, shear force and load, bending stress section modulus, strength requirements, combined bending and tension/compression, eccentric loading, unsymmetrical bending, compound bars deflection of beams. Simple shear force: Shear stress, shear strain,

Hooke's law technical shear. Torsion of circular cross-sections: Torque diagram angle of twist, shear stress due to torsion, transmission to power by shafts, helical springs. Special problems statistically indeterminate problems, thin cylinders and spheres under pressure.

MEEN 206: FUNDAMENTAL OF DYAMICS **(2 Credit Units)**
Kinematics of particles: rectilinear motion, plane curvilinear motion, appropriate choice of reference frame in solving problems, Relative motion, translating axes. Kinetics of particles: Newton's second Law of motion, Work and Kinetic energy method for deriving equations of motion, Impulse and momentum. Kinetics of systems of particles: Defining equations, Steady mass flows, Variable mass problems, Plane Kinematics of rigid bodies; Absolute motion, Relative Velocity, Instantaneous centre of zero velocity, Relative acceleration. Plane kinetic_of rigid bodies: General equation of motion, Translation, Fixed-axis rotation. General planed motion, Work energy relations, Impulse and momentum equations for rigid bodies.

MEEN 208: BASIC THERMODYAMICS **(2 Credit Units)**
Dimensions and Units: (S.I. Units to be introduced): Fundamental concepts: Energy i.e. Potential, Kinetic, internal; property, state, process and cycle system and surroundings; pressure; temperature, Zeroth law, arbitrary nature of temperature, scales; equilibrium reversibility, heat and work. First Law of Thermodynamics: As applied to closed and flow systems, and in the cyclic and no-cyclic (process) forms, as well as in the differential form; Application to particular processes of constant volume; constant pressure, Isothermal, adiabatic, polytrophic and throttling; the flow energy equation and its application to turbines, compressors, nozzles, boilers, condensers, heat exchangers (treated as black boxes only). Second Law of Thermodynamics: Definition of heat engines, Cannot cycles, thermodynamic temperature scale, entropy (as a property). Properties of Pure Substances: Condensable fluids: T-P diagram, P-V diagrams, the two phase mixture, T-S diagram, H-S diagram, the use of property tables and diagrams. Perfect Gases: Properties of perfect gas; entropy changes in perfect gases.

MATH 242: CALCULUS II **(2 Credit Units)**
Infinite number series and their properties, test of convergence complex number series, Improper integral, Improper integral of types I, II and III. Evaluation of improper integral, convergence of improper integral, Convergence in the Cauchy Principle value, test of convergence. Partial differentiation: partial derivatives of functions of two or three variables, total

differentials and applications. Ordinary differential equations: First order differential equations with variables separable, exact equation and integrating factors; linear first order equations and those reducible to linear form, The Bernoulli equation, applications (geometrical and physical situations).

MATH 244: METHODS OF LINEAR ALGEBRA II **(3 Credit Units)**
Determinants and matrices definition and properties of the determinants, its evaluation, matrices addition, multiplication by scalar, adjugate, inverse of non-singular matrix, rank and its evaluation. Simultaneous linear equations, consistency, linear dependence, solution (including Cramer's rule) eigen values and eigen vectors, special matrices, symmetric, skew symmetric orthogonal, etc.

MIEN 222: INDUSTRIAL APPLICATION OF MINERALS **(1 Credit Units)**
Role of mineral industries in national development with emphasis on developing countries, especially Nigeria; Characteristics of successful mining operations; Overview of mineral resource development; Mineral resource and production in Nigeria; Overview of significant Nigerian mineral deposits; and Control of Polution in mining and mineral processing operations.

GEOL 202: ELEMENTS OF STRUCTURAL GEOLOGY **(2 Credit Units)**
The attitude of beds. Introduction to rock deformation, Horizontal, folded and faulted strata and Joints. The effect of topography on outcrop patterns. Unconformities and igneous intrusions. Foliations and lineations. Graphical and trigonometric determinations of attitudes of planes and lines. Interpretation of geological maps and sections; structures and history. Thickness and depth determinations. Outcrop and map areas.

300 LEVEL:

MIEN 311: MINING ENGINEERING I **(2 Credit Units)**
Rocks and minerals: origin, distribution, diagnostic features and classification. Energy, minerals and water resources. Importance of minerals to national development. Development of mining technology – Surface Mining, Underground Mining and excavations etc. Mine Surveying, and the Geographic Information Systems (GIS). Stages in the life of a mine. Unit operations in mining. Mining and its consequences. Processing and uses of minerals. Introduction to geophysical prospecting methods. Government rules and regulations in the Oil and Mineral Industry.

MIEN 321: MINERAL PROCESSING I **(2 Credit Units)**
Structures and textures of Mineral and their significance in Mineral genesis and treatment. Ore analysis: Qualitative and quantitative assaying and mineralogical analysis. Basic Comminution theory, Comminution and liberation. Particle sizing: sizing by screening, sizing by classification. Particle size analysis. Mineral concentration techniques – heavy medium separation, magnetic, gravity, flotation and other separation techniques including the physical and mechanical processes of agglomeration. Hydrometallurgical and Biological recovery processes. Preparation of Metallurgical mass balance: recovery and metallurgical losses. Introduction to essential laboratory experiments in minerals engineering.

MIEN 313: ENGINEERING SURVEYING **(3 Credit Units)**
Maps and plans. Reference datum, bench marks and other global references. The global positioning systems (GPS) – satellites, terrestrial total station, handheld GPS receivers, and other electronic and digital tools. Theodolite – types of theodolite, construction, adjustment and precautions. Unique difference between mining theodolite and land surveying theodolite. Measurement of areas and volumes, use of planimeter. Control measurements. Calculation of co-ordinates. Theory of errors in surveying. Chain, compasses and theodolite surveys. Triangulation. Gridding and Traversing. Level transit and measurement. Application of leveling to topographical mapping. Surveying in open cast mines. Mine survey control in supports and stability of slopes in quarry/open pit mines. Surveying in underground mine systems – control on industrial layout of underground deposits. Geometrical projections of mine rocks and other mine features. Geometrical classification of industrial and non-industrial mineral deposit. Parameters of mineral reserve estimation and methods of quantifying mineral reserve. Concept of displacement in underground mining zone. Process of displacement of mine rooks/earth surface. Factors affecting rock displacement in mineral deposit. Mine survey control on displaced mine rock/earth surface. Application of Photogrammetry and remote sensing in mining. Geographic Information System (GIS) and its application in the mineral industry. Computer application in surveying, mine planning and Field work.

MIEN 315: STRENGTH OF MINE MATERIALS ***(*2 Credit Units)**
Advanced topics in bending moments and shear force in beams. Theory of bending of beams. Deflections of beams. Unsymmetrical bending and shear centre. Application. Strain energy. Biaxial and triaxial state of stress.

Transformation of stresses. Mohrs circle. Failure theories. Springs. Creep, fatigue, fracture and stress concentration. Materials for mine support and analysis of stresses in underground mine support systems. Failure theories and their application in mine materials for accident prevention and process optimization.

MIEN 317: MINE GEOMETRY **(2 Credit Units)**
Introduction to mine geometry: [Definition of mine geometry, Application of geometric principles and spatial analysis in mining]. Importance of mine geometry: [To better understand and manage mining operations, improved productivity in mining operations, higher profitability in mining, optimize mine operations, improve health and safety, reduce costs, and sustainability.] Application of mine geometry in various mining scenarios: [Open pit and open cast design, ore body modelling, drill hole planning, haul road design, underground mine infrastructure components] Arrangements of various components in surface and underground mines. [Anatomy of open pit/open cast with illustrations, Anatomy of underground mine with illustrations] Spatial relationships and arrangements of various components in a mine [Open pit mine, open cast mine, underground mine, ore body shape and orientation, geological structures, drill hole and blast hole patterns etc.] Representation of mine geometry using: [2D maps and plans, 3D models and visualizations, Geographic Information Systems (GIS), Computer-Aided Design (CAD) software, Mine planning and design software (Surpac, MineSight, Vulcan, etc.)] Calculations of pit geometry: [Pit volume, pit surface area, bench width and height] Calculations of orebody geometry: [Orebody volume, orebody tonnage] Calculations of Drill Hole Geometry: [Drill hole spacing, diameter, length and pattern] Calculations of Haul Road Geometry: [Haul road length, width and gradient].

MIEN 391: LABORATORY COURSE WORK I **(1 Credit Unit)**
Practical exposure covering mine survey, geotechnical investigation, mining methods and mineral processing. The students are required to prepare a technical report of the entire field work and present a seminar on the field programme.

GEOL 315: GEOPHYSICS I **(2Credit Units)**
Physical properties of rocks. Concepts of Electrical potential, current density and conductivity of rocks, potential distributions in a homogenous earth and

apparent resistivity. Principles, equipment, data acquisition, processing, interpretation and application of electrical (SP, resistivity, IP and EMO, gravity, magnetic, seismic (refraction and reflection) and nuclear methods of geophysical surveying.

MATH 341: DIFFERENTIAL EQUATIONS AND TRANSFORMS **(2 Credit Units)**
Exact Equations, Linear Equations of first and second order with variable coefficient, geometrical interpretation, isoclines, statement of existence theorem, series solution of differential equation with nonsingular points; definition of Bessel equation and Bessel function of the first kinds, definition of Legendre polynomials. Fourier integral and transforms, Laplace transform and its applications to the solution of differential equations.

QTYS 309: DEVELOPMENT ECONOMICS **(1 Credit Unit)**
Introduction to economics: Elementry concepts, evolution of economic activity, characteristics of modern economic concepts. Basic Economics: Economics of taxation and public expenditure, business organization, industrial concentration and government control. Location of West African industry and trade: Background of West African economy, economic planning, development problems. The banking system: Money and Capital Markets, inflation, cost-benefit analysis.

MIEN 310: MINE SURVEYING (**3 Credit Units**)
Mining theodolite. Unique difference between mining theodolite and land surveying theodolite. Surveying in open cast mines - building and construction of an open cast deposit. Calculations for drilling, blasting, excavation, transport operations and drainage. Mine survey control in supports and stability of slopes in quarry/open pit mines. Factors affecting stability and deformation of slopes in quarry or open pit mines. Methods of calculation of angle of slope in quarry or open pit mines. Surveying in underground mine systems - control on industrial layout of underground deposits. Construction of shaft and shaft lift; mine survey work on contact with mineral surface (lava). Geometrical projections of mine rocks and other mine features. Geometrical classification of industrial and non-industrial mineral deposit. Parameters of mineral reserve estimation and methods of quantifying mineral reserve. Concept of displacement in underground mining zone. Process of

displacement of mine rooks/earth surface. Basic understanding and parameters that characterize the process of rock/earth/displacement. Factors affecting rock displacement in mineral deposit. Mine survey control on displaced mine rock/earth surface. Application of Photogrammetry and remote sensing in mining. Geographic Information System (GIS) and its application in the mineral industry. Computer application in surveying, mine planning and field work.

MIEN 312: DRILLING AND BLASTING **(3 Credit Units)**

Rock characteristics affecting drilling - engineering properties of rock material rock drillability and blastability. Classification of drilling and penetration methods. Theories of rock penetration. Rotary, percussive, rotary-percussive and thermal drilling. Drill bits and their applications. Diamond drilling and Core recovery. Basic parameters affecting bench drilling (bench height, burden, spacing and drilling pattern). Choice of drilling equipment. Drilling components manufacturing process (drilling rods, bids, coupling, pistons etc.). Handling and maintenance of drilling equipment. Definition of explosives. Brief history of explosives. Terminology and definition – velocity of detonation, density, detonation pressure, sensitivity, strength, and water resistance, fume characteristics. Properties and classification of explosives – dynamites, ammonium nitrate and fuel oil (ANFO) Cracking agents. Explosive accessories. Magazine construction. Blasting methods and practices in surface and underground workings. Blasting patterns; special blasting techniques – smooth, presplitting, secondary blasting procedure. Disturbances created by blasting. Applications in dimension, aggregates, water well, water works, hydropower, road works, railways, pipelines, built-up areas etc under water blasting, underground blasting (tunneling, shafts, Chambers).

MIEN 314: ROCK MECHANICS **(3 Credit Units)**

Introduction to Rock Mechanics – Definition of terms and importance of rock mechanics; field applications in Mining, Civil and Petroleum Engineering. Classification and Index properties of rocks – Geological classification of rocks (crystalline rocks, organic rocks); Porosity Density; Permeability; Strength: Slaking and Durability: Sonic velocity as an index to degree of fissuring; Classification of rock masses for engineering purposes. Rock strength and Failure Criteria Modes of failure of rocks Common Laboratory strength tests (Uniaxial, Triaxial, Brazilian, Flexural tests); Stress-Strain behaviour in compression; Effect of confining pressure; the meaning of rock strength; Application of the complete Stress-Strain curve. The Mohr Coulomb

failure criterion; The effect of water; The influence of the principal Stress ration on failure; Empirical criteria of failure; Coulom-Navier criterion of failure of rocks; Griffith brittle failure Criterion. Elastic properties. Applications of rock mechanics in engineering or underground openings. Rock slope stability. Support systems design and selection – caving and subsidence. Observation of mass deformations – extensometers and strain transducers. Case studies.

MIEN 322: MINERAL ANALYSIS **(2 Credit Units)**
Introduction of tests and analyses carried out for the purpose of designing Mineral beneficiation flow sheets; Laboratory Practicals on Sampling; Chemical and Assay analysis using Atomic Absorption Spectrometry (AAS), X-ray Fluorescence (XRF), Fire Assay and SEM-EDS; Mineralogical analysis using X-ray Diffraction Analyser (XRD); Size and assay analysis using sieves and AAS/XRF, Liberation studies, Work index determination and Separation Tests.

MIEN 324: MINERAL PROCESSING II **(2 Credit Units)**
Dewatering, flocculation and dispersion. Thermal and agglomeration techniques: thermal drying, calcinations, sintering, palletizing, briquetting, theory and practice of thickening, filtration and drying. Process and ore sampling techniques. Analysis of comminution theory. Criteria for selection of crushing, grinding and screening equipment for mineral concentration processes. Selection of concentration techniques for downstream processes. Selection of mineral concentration equipment. Design, testing and evaluation of mineral beneficiation flow sheets for copper, tin, lead, zinc, iron, gold and other ores. Materials handling methods – Holding and transport of bulk solid, storage, holding and transport of fluids in mineral processing plants. Feeding and materials reclaiming systems. Smelting plants etc. On-line analysis, process control and automation. Tailings disposal.

MIEN 326: ARTISANAL AND SMALL-SCALE MINING AND MINERAL PROCESSING **(2 Credit Units)**
Definition of Artisanal and Small-Scale Mining (ASM)., Differences between Medium and Large-Scale Mining and Artisanal and Small-scale Mining. Examples of mode of operation of ASM e.g., gold, tantalite, granite, sand and gravel, Tin, Columbite and other precious minerals. Financing of ASM operations. Occupational Health and safety hazards Associated with small scale informal mining operations. Problems and prospects of ASM operations. Involvement of women and children in ASM. Government regulation of ASM

operations in Nigeria, Ghana and South Africa.

GEOL 414: GEOLOGY AND MINERAL RESOURCES OF NIGERIA **(2 Credit Units)**
General description of the geology of Nigeria. Significant and potential mineral resources of Nigeria: Energy (hydrocarbons, coal, uranium); Metallic (tin, tantalum-niobium, gold, lead-zinc, chromium; Non-metallic (limestone-dolomite, clays, sand-aggregates, feldspars, laterites, barites, evaporates, gemstones).

MIEN 328: MINERAL EXPLORATION METHODS **(2 Credit Units)**
Geology applied to mineral exploration. Zoning, wall-rock alteration paragenesis, etc. Principles of fluid inclusion and stable isotope studies. Ore evaluation and economic parameters of mineral deposits. Resources and reserves. Reserve estimation by pitting, trenching and drilling. Grade and tonnage. Drill-hole section and plan interpretation methods of core logging. Historical aspects of the mining industry, with emphasis on Nigerian example where possible. Mineral policy and environmental conservation.

MIEN 316: MINE CAMP (DRILLING AND BLASTING PRACTICALS) **(3 Credit Units)**
One Week Blasting and Drilling Practicals entailing Drilling Pattern Design, Charge Calculations, Blast hole Drilling, Explosive Charging, Blasting and Mucking Operations.

400 LEVEL:

MIEN 411: SURFACE MINING **(3 Credit Units)**
Analysis of elements of surface mine operation. Design of surface mining systems with emphasis on minimization of adverse environmental impact and maximization of efficient use of mineral resources. Factors affecting stability and deformation of slopes in quarry or open pit mines. Methods of calculation of angle of slope in quarry or open pit mines. Surface excavation. The uses, handling and maintenance of surface equipment and plants. Ore reserve estimates, grade control (blending and dilution), short and long range planning, unit operations, equipment selection, cost estimation, slope stability and Placer mining operation. Aggregates quarrying and dimension stones production. Ore handling equipment. Case studies of typical surface mines: coal, metallic and non-metallic mines. Scheduled Field trips to operating mines.

MIEN 413: OIL/GAS WELL DRILLING TECHNOLOGY **(2 Credit Units)**
Techniques for oil/gas well drilling. Drilling rigs: equipment, hoisting, drill string, casing, drill bits and drill string design. Circulating system-drilling fluids, drilling hydraulics. Functions of drilling mud, types and fundamental properties of drilling mud. Drilling, casing and completion programmes. Drilling performance. Offshore drilling rigs. Drilling line design consideration, mud engineering. Rig hydraulics, Casing design, Functions and types of casing, Strength consideration and loading. Cementing-functions, classes and types cement, properties of cement slurry, mechanics of cementing. Hole problems. Formation characteristics and associated drilling problems. Directional drilling and multi-zone completion. Well head equipment. Planning and materials selection for drilling programmes. Lithological sequence in the Niger Delta and drilling for oil and gas. Fishing work-over and well conversion. Site visit.

MIEN 415: MINE VENTILATION **(3 Credit Units)**
Fundamentals of mine ventilation. Techniques for the control of dust, temperature, humidity, gas. Physiological effects and dangers of poor mine ventilation. Basic principles of mine ventilation design. Design of flow of air through ducts and mine opening. Ventilation Equipment (axial flow fans, centrifugal fans, refrigerators, air-conditioners etc.). Equipment selection, criteria, maintenance, instrumentation and air measurements. Evaluation of efficiency of ventilation systems. Testing of refrigeration and air-conditioning equipment, leak detection methods: charging and other service procedures for refrigeration and air-conditioning systems, Trouble shooting. Construction of air ducts**.**

MIEN 421: PRECIOUS STONE TECHNOLOGY **(2 Credit Unit)**
Description of gemstones, Properties of gemstones, Mode of occurrence, Gemstone types and locations in Nigeria, Gemstone identification methods, Gemstone mining, Gemstone processing, Gemstone trade and legal requirements. Lapidary techniques: sawing, grinding, sanding, lapping, polishing, drilling, tumbling of gemstones; Lapidary forms: tumbling, cabochon-cutting and faceting of gemstones, Basics of faceting process; jewelry-making with gemstones, bead-making with gemstones, jewelry making tools, stone setting.

MIEN 423: MINERAL ECONOMICS **(2 Credit Units)**
Variation in ore grade, non-renewable asset, increases in funding with increase in depth, wealth conservation. Global production and consumption patterns of

major mineral commodities. Structures of established mineral market, supply and demand; mineral pricing. Projecting and forecasting methods; marketing research. Mine-legislations and the mineral industry: Public and the mineral act, mineral disposal systems, mineral taxation policy, conservation and the preservation of the environment, etc. International bodies related to mineral industries like OPRC, ITC: their relevance to national development. International politics and the minerals industries especially its impact on the developing nations.

MIEN 425: TECHNICAL REPORT WRITING **(1 Credit Units)**
An introduction to the planning and writing technical and scientific reports. Introduction to different study skills. Information search and retrieval techniques. Organizing information for technical and scientific reports. Audience types, psychology, speech qualities and verbal presentation of technical/scientific report. Feasibility study techniques. Referencing and reference citation and listing methods. Team working. Acquisition and technical presentation of mineral resource assessment data. Selected and simulated case studies.

MIEN 491: LABORATORY COURSE WORK III **(1 Credit Unit)**
Practical on corrosion, smelting, electrometallurgy and mine ventilation.

STAT 443: EXPERIMENTAL DESIGN AND CONTROL **(2 Credit Units)**
Analysis of variance, randomized blocks, Latin squares, simple factorial designs, statistical quality control, control charts for means, standard deviation, image, number of proportion of defective and defects. Acceptance sampling (sampling inspection plans examples of single, double, multiple and sequential sampling, plants) the operating characteristics (OC) curve, producer's and consumers, risks, average sample number (ASN) and average outgoing quality level (AOQL), Linear programming.

GEOL 405: HYDROGEOLOGY **(2 Credit Units)**
The hydrological cycle. Occurrence and movement of groundwater. Aquifers: classification and hydraulic properties; introduction to laboratory and field determination of aquifer hydraulic properties; introduction to pump test analysis. Well location and esign. Hydrogeological maps; Water quality; Physical, chemical and biological. Stiff and Piper diagrams. Pollution. Introduction to groundwater prospecting. Regional hydrogeology of Nigeria. Concepts of Water Resources and Water Resources Management.

GEOL 417: PETROLEUM GEOLOGY **(2 Credit Units)**
Origin, migration and accumulations of hydrocarbons; characterization of source and reservoir rocks. Surface and subsurface occurrences of hydrocarbons. Physical and chemical nature of reservoir fluids; preservation, distribution, maturation and destruction of organic matter (Petroleum cycle and palaeoenvironment of source rocks); organic matter types. Hdrocarbon trap types and abnormal formation pressures. Evaluation and prospects of petroleum potential of a virgin sedimentary basin; reserve estimation and construction of subsurface maps and sections. Petroliferous horizons with case histories from Nigerian.

MIEN 497: STUDENT INDUSTRIAL WORK EXPERIENCE SCHEME **(6 Credit Units)**
The programme is embarked upon in the second semester of 400 level and long vacation. A comprehensive internship programme in which students spend a period of six months in approved Mining Engineering establishments (private and public) and industries. The exposure also provides opportunity for students to sharpen their technical writing skills through field reports, keeping log-books and prepare technical documents under close supervision of professionals and lecturers. The students are to be assessed by Industry-based Supervisor, ABU Supervisor and through Student's Report and Seminar Presentation.

500 LEVEL:

MIEN 511: UNDERGROUND MINING **(3 Credit Units)**
Selection, design and development of most suitable underground mining methods based on the physical and geological properties of mineral deposits. Unsupported and supported underground mining methods. Tunneling Engineering; construction and maintenance. Underground Mining systems. Mining of averagely thick and thick deposits. Equipment, conveyors, cable ropeways and rope haulage, tract and trackless mining systems, hydraulic transport and pipeline systems. Calculations of ore reserve estimates, development planning and preparations for development and extraction, construction of development openings. Conservation and environmental systems Case studies of typical underground mines: coal, metallic and non-metallic scheduled. Field trip(s) to operating mines and Tunnels.

MIEN 513: MINE AND MINERAL PROCESSING EQUIPMENT AND MACHINERY **(2 Credit Units)**

Essential features of a machine: gears, shaft, bearings, couplings etc. Construction and application of wire rope used in mine machinery. Hoisting equipment care of ropes. Types of pumps and their application. Pumps characteristics compressors-reciprocating, piston and rotary types, characteristics and choice of compressors. Surface mine Machinery. Power shovel, front-end-loaders, dragline, hydraulic excavators, bucket wheel excavators, bucket chain excavators, rippers, scrapers and bulldozers. Dump trucks. Underground mine machinery: Loaders – gathering arm loaders, bucket type loaders, front-end-loaders, and load-and slushier. Coal cutter, Power arch, Nut and Bolt support. Transport and Haulage: Railways (locomotives, wagons, tracts); train ways, trolley; conveyor belts, rope haulage-direct and endless rope, rope way. Mineral processing plant equipment: Crushers (Jaw, Gyratory & Cone), Grinding mills (Rod Mill, Ball mill, High Pressure Roll Mills), Screens, Classifiers, Concentration equipment (Tables, Jigs, Spirals, Flotation Cells, Magnetic and Electrostatic Separators, Enhanced gravity concentrators), Slurry Pumps, Fans, Filters and Dryers. Dredges hydraulic monitors and gravel pumps, sluice boxes. Maintenance of mine and mineral processing plant machinery; routine, emergency, periodic overhaul, planned maintenance. Reliability and availability of equipment. Workshop and maintenance tools. Lubricants.

MIEN 515: MINE MANAGEMENT **(2 Credit Units)**

Definition of Management: Kinds of manager criticize, role and skills of manager, acquiring the skills of manger. Basic concept of management. Management structure. General principles functions and responsibilities of management under planning, organization directing, controlling and coordinating. Different forms of business organizations. Wage systems. Industrial relations. Introduction to innovative thinking, project development, planning and execution. Project appraisal and feasibility studies. Types of business and ownership structure of business enterprises. Product/business registration and patient right. Project financing and product marketing strategies. Sources of fund for project financing. Financial feasibility, project valuation and risk assessment. Budgeting and financial statements analysis. Material procurement methods. Contracts initiation, execution and management. Nigerian Minerals and Mining Act, 2007 and its Regulation, 2011. Planning and Decision Making Destruction of planning, types of plans, steps in planning, objective versus goals, kind of goals, making goal, setting effective organizational goals and planning strategic management. Organizing: Human Resources, Planning and recruitment of personnel;

compensation and benefits, training and development. Human Factors. Motivations and leadership. Herzberg: Two – factor model: Abraham Maslow: Two – factor model leadership. Controlling: Destructives and propose of control, types of control, factors of control, management by objectives (MBO), management by exception (MBE), management by delegation (MBD).

MIEN 517: MINE DESIGN **(2 Credit Units)**
Design of surface mine excavation methods. Determination of bench parameters. Calculation of the width of working platform of the bench. Determination of the optimum depth of a surface mine. Selection of mine equipment and machinery. This include draglines, loaders, power shovels, drilling rigs, jack hammer, compressor, conveyor, belt etc. Feasibility study of a proposed quarry. Design of a surface mine using an existing data. Software applications to surface mine design in planning and organization using various software packages in the laboratory. Slope design in surface mines to ensure safe operation. Practical exercise. Design and construction of shafts, winze and raise. Phases of shaft construction. Different methods of shaft sinking such as bench method and Jora lift method. Detailed shaft site investigation in order to optimised construction cost and time to ensure safety. Detail discussion on hoisting machines, tunnel, drifts and adit design and constructions. Various methods of tunneling in underground mines using tunneling machines and explosives. Drilling and blasting parameters in shaft sinking and tunneling. Design of powered supports arch and nut and bolt supports. Design of ventilation systems in underground mines. Selection of the best methods of mining during the design of underground mines. Application of software packages to underground mine design.

MEEN 503: PRODUCTION MANAGEMENT I **(1 Credit Unit)**
Investment Analysis: *Relevant costs* – Break even analysis; compound interest factors; locomonic alternatives; Production: Planning; Sales forecasting technique; Determination of factor-production requirement. *Factory Design:* Siting of factory; space requirements; development of departmental arrangements; plant layout; materials handling. *Production Control* : Production control in intermittent manufacture and continues manufacture, linear programming; critical path scheduling; factory organization; types of organization; Personnel functions; sales organization; purchasing; welfare and financial control.

MIEN 519: PETROLEUM RESERVOIR ENGINEERING **(3 Credit Units)**

Introduction to hydrocarbon reservoir. Origin, migration and accumulation of oil and gas. Composition of petroleum, state of petroleum. Types of traps. The Niger delta. Petroleum reservoirs: Gas-reservoirs, Gas-condensate reservoirs, unsaturated reservoirs, and oil reservoirs under various drive mechanisms. Material balance applied to oil reservoirs. Fluid flow in reservoirs. Mechanism of fluid flow in porous media, Drilling, Completion and Work over, Production and Christmas-tree, pressure, build-up survey, Amarada, well flowing, choke and arrival manifolds, Heaters, separators, Well flow measurement and monitoring. Monitoring and measuring devices. Reservoir and well modeling and simulation.

MIEN 527: EXTRACTIVE METALLURGY **(2 Credit Units)**
General classification of metals. Periodic Table. Industrial classification into Heavy, Light, minor, Noble, Refractory, Rare-earth, Disseminated and Radio – active metals. Principles of Extraction of Ferrous and Non-Ferrous Metals by Pyrometallurgy (Ellingham diagram for oxides, applications and uses in metal extraction and other areas. General principles of smelting/reduction of oxides, slag formation, refining of the molten metals. Simple charge calculations (material and mass balances) in smelting); Hydrometallurgy (Types and methods of Leaching, Treatments given to leached liquor prior to recovery of valuable metals: solid-liquid separation, concentration and purification of leached liquor by solvent extraction, Ion Exchange, Carbon Absorption. Recovery of Valuable metal from leached liquor by Chemical precipitation, Cementation, electrowinning etc.,); Electrometallurgy (General principle of Electrolysis, Aqueous and fused salt Electrolysis electrowinning and electrorefining processes and applications in extraction and refining of metals, limitations and factors influencing the choice of a refining process). Application (Study of typical extraction and refining flow sheets of the following non-ferrous metals. Tin, Copper, Aluminium, Lead and zinc, Tin, Gold); Refining Plants. Introduction to iron- and steel-making: The blast furnace ironmaking and alternative processes; Bessemer, Basic oxygen and Electric furnace steelmaking processes; Secondary steelmaking processes.

MIEN 522: TECHNOLOGY POLICY AND DEVELOPMENT **(2 Credit Units)**
The objectives of the course are to draw students' awareness to the link between scientific and technological knowledge and productive capacity. The emphasis will be on rational utilization of technology as an economic resource in Nigeria. Science, technological knowledge and productive capacity: implication for planning in developing country. In-depth of the scientific

infrastructure; structure of science-based industry: vertical specialization and the role of R and D and innovation. The acquisition of technology as a resource; its role as vehicle for monopolistic control; mechanisms of technology transfer; industrial forms of foreign investment; bargaining for acquisition of technological know-how. Technology of policy: its design and implementation in Nigeria; the structure of science and technology. The sociology of scientific community.

MIEN 512: MATERIALS HANDLING **(2 Credit Units)**
Definition, Haulage System (Rail or track mounted – rope haulage, Locomotive haulage – Electric, Battery, Combination, diesel, compressed air, Trackless or Tyre haulage – automobiles, LHD, shuttle car, underground trucks, Conveyor systems, Hoisting or winding systems, Aerial Ropeways, Track and Mine Car, Hydraulic transport

MIEN 514: MINE VALUATION **(2 Credit Units)**
Mine valuation concept. Methods of sampling. Ore reserve calculations and statistical analysis applied to the valuation of ore deposits. Methods of financial appraisal and valuation criteria for project selection. Leases, royalties and taxation: Interest rates, calculation of depreciation, depletion and increasing costs. Estimating future costs and profits. Feasibility studies in Mining and mineral projects. Evaluation of Turn-Around-maintenance of mineral facilities.

MIEN 516: HEALTH AND SAFETY IN MINING INDUSTRY **(3 Credit Units)**
Importance of Mine Health and Safety to mining industries. Safety in surface and underground mines operations. Safety in mineral processing plants. Safety regulation in the handling of blasting accessories such as explosives, detonators, blasting caps and safety fuse. Construction and maintenance of explosive and detonator magazine for safe operation. Identification of the courses of mine fire, dust and gas explosion in mines. General safety rules and regulations in the mining industries in Nigeria. Mine health and safety regulations. Industrial visit to quarries and other mining industries for Health and Safety assessment.

MIEN 524: ENVIRONMENTAL IMPACT ASSESSMENT OF MINING OPERATIONS **(3 Credit Units)**
Environmental pollution: definitions, causes and interrelationships. Gaseous and particulate pollutants and their sources. Mine atmosphere: detection of

mine gases, physiological effects, inflammation and detonation, gas layering and diffusion. Dust hazards. Pollution monitoring and control, methods of controlling gaseous and particulate pollutants. Mine effluents, effects on air, surface and ground water, and land. Spontaneous combustion, acidity, etc. Tailings Dam Management and Contol. Methods of effluent treatment. Impact of mining on mine environs effects on agriculture, surrounding habitats, etc. Methods of reclamation. Mine drainage: water recovery and re-cycling.

MIEN 526: MINING LAW **(2 Credit Units)**
Types and Geometry of Mineral Titles; Qualification of Mineral Title Applicants; Procedures for acquiring Mineral Titles; Requirements (supporting Documents) accompanying mineral title applications; Mineral Title Fees; Contents of Mandatory Periodical Reports submitted to Regulatory Ministries, Departments and Agencies; Mineral Title Modifications/Renewal/Relinquishment/ Assignment/Revocation, etc.; Case Studies.

MIEN 528: SOFTWARE APPLICATIONS IN MINING AND MINERAL PROCESSING **(2 Credit Units)**
Review of applicable computer programmes and programming languages in mining and minerals engineering operations including such software as Split-Desktop for rock fragmentation analysis, SuperMinex5 (with DrillKing, SurpacV5 and Logmate) for surface and underground mining operations, GIS software such as ArcView, MapInfo, Illwis Academic, the sufer series, etc for map making and BRUNO (Meso. Minerals Process Simulator), JKSmiMet, JKSimfloat and USIMPAC series for simulating mineral processing operations; Projects in software development in relevant areas of the mining operations. Computer simulation of mining and processing operations using case studies with any existing or developed software

MEEN 502: PRODUCTION MANAGEMENT II **(1 Credit Unit)**
Work study: *Lotion Study:* Method study objectives; Basic procedure; process charts; activity chart, motion study. *Time study:* Stop watch time study; standard data method and waiting line analysis. *Inventory Control:* Relevant factory; economic lot sizes; inventory control under risk; inventory levels and production schedule; inventory decision rules and simulation. Statistical quality control; Control shirts for variable; defectives and defects; acceptance sampling; design of acceptance sampling; design of acceptance sampling plans. *Job Evaluation*: Job specification – quantitative and non-quantitative systems of job evaluation. Wage incentives: Incentive plans; day rate plan; full

participation plan; less than full participation; step plan.

MIEN 599: FINAL YEAR STUDENT'S PROJECT (6 Units)
The student prepares a project report in the final year of study on a selected and approved research project in any aspect of the discipline. The student is expected to plan and carry out an investigation on a project under the supervision of a member of staff. The project shall be assessed by the project supervisor and the External Examiner.

3.3. The Course Credit System

The course units in the Department are organized on the course credit system per semester. A semester lasts for approximately 18 weeks, including the periods of registration and examinations provided that not less than 15 weeks are devoted to actual teaching. One credit unit is the equivalent of 15 contact hours of classroom teaching or 30 hours of laboratory work. Most of the course units in the Department carry the weight of 3 or 2 credit units, suggesting that they are taught for 45 or 30 hours in the semester or 3 or 2 one-hour periods per week. In courses with strong practical component, this means that there are 15 hours of teaching and 45 hours of practical to qualify for 2 credit units or 30 hours of teaching and 45 hours of practical for 3 credit unit courses. However, there are fewer 3 credit unit courses which suggest that more work is required to be done in 45 contact hours per semester or the equivalent in terms of practical and classroom teaching.
At the end of each semester, a final examination is given to bring the course to final conclusion. The final examination in each course unit is weighted 60% of the component while CA/assignments carries the weight of 40% of total marks for the course.
No student can pass in a course unit if he/she fails to submit the CA/assignments.

3.4. Computing Grade Point Average (GPA) and Cumulative Grade Point Average (CGPA)

Using an example of a 100 level student in the Department with the following results in the first semester: and second semester, the GPA and CGPA are computed as follows
First semester

(a) Course	(b) Grades	(c) Grade points	(d) Credit Units	(e) Credit points (c*d)
PHYS 111	65(B)	4	2	8

PHYS 131	73(A)	5	2	10
PHYS 161	70(A)	5	1	5
CHEM 111	63(B)	4	2	8
STAT 101	72(A)	5	1	5
MATH 101	73(A)	5	1	5
MATH 103	67(B)	4	1	4
MATH 105	75(A)	5	1	5
MATH 107	47(D)	2	1	2
GEOL 101	41(E)	1	2	2
CHEM 121	57(C)	3	2	6
			16	60

Registered Credit Units (RCU) = 2+2+1 +1 +2+1+1+1+1 +2+2+2 = 16

Earned Credit Units (ECU) = 2+2+1 +2+1+1 +1+1 ++2+2 = 16

Thus, First Semester Grade points average (GPA) = $\frac{60}{16}$ = 3.75

Second semester

(a) Course	(b) Grades	(c) Grade points	(d) Credit Units	(e) Credit points (c*d)
PHYS 122	75(A)	5	2	10
PHYS 142	72(A)	5	1	5
PHYS 162	64(B)	4	1	4
MATH 102	69(B)	4	2	8
MATH 104	70(A)	5	2	10
MATH 106	78(A)	5	2	10
MATH 108	75(A)	5	1	5
COSC 100	72(A)	5	2	10
CHEM 112	56(C)	3	2	6
			15	68

Thus for second semester (GPA) = $\frac{68}{15}$ = 4.53

CGPA = $\frac{\text{Previous TCP + Present CP}}{\text{Previous TRCU + Present RCU}}$

Where: TCP: Total Credit Points

CP: Credit Points
TRCU: Total Registered Credit Units
RCU: Registered Credit Units
CGPA: Cumulative Grade Point Average

Hence,

$$CGPA = \frac{60 + 68}{16 + 15} = 4.13$$

3.5. Examination Guidelines

3.5.1 General Guidelines

i. Examinations are normally held at the end of each semester. Examinations may take the form of written papers, oral examinations, practical, the submission of projects, any combinations of these, or any other form approved by the senate. The continuous assessment of course work should be included in determining examination results.

ii. Notwithstanding any provisions to the contrary in these regulations, the senate reserves to itself the power to decide any case on the basis of what appears to it to be fair and just in the circumstances of the case; and to approve examination results in spite of any breach of these Regulations, if the senate is satisfied that the said breach has not substantially affected the examination results.

3.5.2 Eligibility

i. In order to be admitted to any examinations a student must have been registered for the course-units to be examined and must have fulfilled any university requirements concerning residence, fees or other matters. At least 75% attendance is required in all classes, tutorials, laboratories, field/studio practical training etc., to qualify to sit for semester examinations. He/she must also have fulfilled any Faculty requirements regarding attendance at or satisfactory completion of any course-work, practical, assignments, projects or other matters. The standards necessary to satisfy these faculty requirements shall be determined from time to time by a Faculty Board on the recommendation of the appropriate departments, and any changes shall be made known to the students by the start of the relevant teaching

ii. The Registrar shall prepare examination cards with appropriate examinations numbers for issue on the application of students at least two weeks before the semester examinations begin. These cards will

be prepared on the basis of lists of student admitted by each Faculty Examination Officer, who shall certify that the students have been registered for the programme of studies shown for them and have not infringed any Faculty requirements or, so far as the Faculty Examinations Officer has information, any University requirements for admission to Examination.

iii. Before issuing an examination card to any student, the registrar shall confirm that the student has been registered in the Academic Office for the programme of study and has not infringed any University requirements for admission to examinations.

iv. It shall be the responsibility of each student to make sure that he is registered for the appropriate examinations and that he knows the dates, times and places of the examinations for which he is registered. In order to be admitted to any examinations a student must have been registered for the course units to be examined and must have fulfilled any University requirements concerning residence, fees or other matters. At least 75% attendance is required in all classes, tutorials, laboratories etc. to qualify to sit for semester examinations. He must also have fulfilled any departmental requirements regarding satisfactory completion of any course work, practicals, assignments, projects or other matters.

3.5.3 Conduct

i. A student shall be at the examination room at least ten minutes before the advertised time of the examination. A student is required to supply his own pens, pencils, rulers, etc.

ii. A student may be admitted up to forty-five minutes after the start of the examination but he shall not be allowed extra time. If a student arrives later than forty-five minutes after the start of the examination, an Invigilator may at his discretion admit him if he is satisfied that the student has good reasons for his lateness. The Invigilator shall report the circumstances to the Faculty Examinations Officer who shall advise the Board of Examiners which shall decide whether or not to accept the student's paper.

iii. A student may be permitted by an Invigilator to leave the examinations room during the course of an examination provided that:-

a. No student shall normally be allowed to leave during the first hour or last fifteen minutes of the examinations.

b. A student must hand his script to the Invigilator before leaving if he does not intend to return.

c. A student who leaves the examination room shall not be readmitted unless throughout the period of his absence, he has been continually under the supervision of an Invigilator or Assistant Invigilator.

iv. A student shall bring his examination card to each examination and display it in a prominent position on his desk.

v. Each student shall complete a form bearing his number, name and signature which shall be collected by the Invigilator of each examination.

vi. During an examination, no student shall speak to any other student or, except as essential, to the Invigilator, or make any noise or disturbance.

vii. No book, printed-paper or written document or unauthorized aid may be taken into an examination room by any student, except as may be stated in the rubrics of any examination paper.

viii. A student must not during an examination directly or indirectly give assistance to any other student or permit any other student to copy from or otherwise use his papers. Similarly, a student must not directly accept assistance from any other student or use any other student's papers.

ix. If any student is found to be, or is suspected of, infringing any of the provisions of paragraphs (i) to (viii) above or in any way cheating or disturbing the conduct of the examination, a report shall be made as soon as possible to the Faculty Examinations Officer and the Dean. The Dean will cause the circumstances to be investigated and reported to the Board of Examiners, and take such steps as may be necessary for the smooth conduct of examinations. The student concerned shall be allowed to continue with the examination provided he causes no disturbance but the Board of examiners may subsequently recommend to the Faculty Board and Senate whether his paper should be accepted and as to any other action that should be taken in the case.

x. A student shall write his examination number, **not his name,** distinctly at the top of the cover of every answer book or separate sheet of paper.

xi. The use of scrap paper is not permitted. All rough work must be done in answer books and crossed neatly through, or in supplementary answer books which must be submitted to the Invigilator. Except for the printed question paper, a student may not remove from the examination room or mutilate any paper or other material supplied.

xii. At the end of the time allotted, each student shall stop writing when instructed to do so and shall gather his scripts together in order for collection by the Invigilator.

3.6. Results

Semester grades are calculated as Grade Point Average (GPA) on the basis of A (70 -100), B (60 - 69), C (50 - 59), D (45 - 49), and F (0 - 44) which are equivalent to 5, 4, 3, 2, and 0 Grade Points (GP), respectively. The approved scoring and grading system for all examinations conducted within the university is as summarized in Table 2.

Table 2: Approved scoring and grading system

(i)	(ii)	(iii)	(iv)	(v)	(vii)	(vii) class of Degree
Credit Units	Percentage Scores	Letter Grades	Grade Points	GPA	CGPA	
Vary according to contact hours assigned to each course per week per semester and according to workload carried by each student	70-100	A	5	i*iv divided by total credit units	4.50-5.00	First class
	60-69	B	4		3.50-4.49	2nd Class Upper
	50-59	C	3			
	45-49	D	2		2.40-3.49	2nd class Lower
	0-44	F	0		1.50-2.39	Third class
					<1.50	Fail

i. The minimum pass mark is 40% or GPA of 1.00 is required for graduation in the university but in engineering, the minimum pass mark is 45% In order to obtain an overall pass in the examinations in any year of study, a student is required to maintain a CGPA of at least 1.50 to be in "good academic standing"; a student whose CGPA falls below 1.5 at the end of any year of study shall be placed on probation.

ii. A student who remains on probation for two consecutive semesters and who fails to attain the status of "good academic standing" at the end of that year of study shall be withdrawn from the program of study.

iii. Failure in any course shall be recorded as such and can only be redeemed by re-taking the course as carry-over and passing the examination, but both the initial GP and the "carry-over" GP shall count towards the CGPA. Subject to the conditions for withdrawal and probation as set out above, a student may continue to re-take the failed course unit(s) at the next available opportunity provided that the total number of credit units carried during that semester does not exceed 24.

iv. A student who is absent from any examinations shall be deemed to have failed the course-units missed, unless allowed as below to sit as his first attempt. Senate on the recommendation of the relevant Faculty/School Board may allow the student to sit the missed course-units later, as his first attempt, if the absence is explained on medical grounds (including, for a female student, being more than 34 weeks pregnant), certified by an Ahmadu Bello University Medical Officer. The student's overall results for the first attempt shall then be assessed and if a supplementary examination should be taken then, the Faculty/School Board may allow this if it can be arranged in time, failing which the student shall repeat the course-units. In any case, where a student has been absent from any examination on other than medical grounds, or he was absent on medical grounds but this was not certified by an Ahmadu Bello University Medical Officer, then the Senate on the recommendation of the relevant Faculty/School Board may only allow that the student's sitting the missed course units later should be accepted as his first attempt.

v. A student who is admitted to a program of studies for a first degree without having initially fulfilled the University General Requirement in English Language shall fulfil it before graduation.

vi. The number and titles of the core and elective course-units to be examined shall be as specified in the syllabus approved by Senate.

vii. The Faculty Board may determine from time to time, on the recommendation of the Departments concerned, and shall make any change known to the affected students by the start of the relevant teaching:-

a. The method of determining continuous assessment marks.
b. The weight to be given continuous assessment marks, in the marks for each course-unit provided that the total of the continuous assessment marks for any year of studies shall fall within range from a minimum of 40% up to a maximum of 60% of the aggregate marks allowed for the year;
c. Continuous assessment which for this purpose includes routine term papers, frequent tests (formal and internal), assessment in workshop/laboratory/studio/field/clinics/medical wards/ exhibitions/ assignments etc. as may be applicable to respective disciplines;
d. At least two continuous assessment tests must be given per course for semester;
e. Continuous assessment and semester examination marked scripts must be returned to the students within reasonable time.

The first degree, shall be classified according to the student's final CGPA as follows:

CGPA	Classification of Degree
4.50 -5.00	First Class
3.50 -4.49	Second Class (Upper Division)
2.40 -3.49	Second Class (lower Division)
1.50 -2.39	Third Class
<1.50	Fail

3.7. Notification of Results

After the Faculty Board has decided on the recommendations to be made to Senate, the Dean may publish them to the students as provisional examinations results subject to approval by Senate. The Head of Department may notify students of the letter grades and CGPA they have obtained. Transcripts of examinations results may only be issued on request to institutions of higher education and to institutional sponsors. Certificate

of the award of degrees approved by the Senate shall be issued to successful graduates.

3.8. Discipline

The examinations regulations set out above bind all students, breach of which carries serious punishments prescribed as follows:

3.8.1 Expulsion from the University

The following offenses shall carry the punishment of expulsion: Impersonation at examinations. This may involve the exchange of examination numbers/names/answer sheets or the intentional use of someone else's examination number. Introduction of relevant foreign materials and cheat notes into the examination hall. Exchange of relevant materials in examination hall which may involve the exchange of question papers containing relevant jotting and materials, collaboration/copying from each other, exchange of answer scripts, Theft/Removal of examination scripts or materials, Mischief by fire to examination scripts or materials, Copying from cheat notes, Consulting cheat notes outside the examination hall, Facilitating/abetting cheating.

3.8.2 Rustication for one academic year

The following offenses shall carry the punishment of rustication for one session:
Speaking/conversation during examination, writing on question papers/scripts.

3.9. Outline of Academic Schedules

(a) 1st Semester

Orientation and Registration		
New Students	-	2 Weeks
Returning Students	-	1 Week
Lectures	-	15 Weeks
Examination	-	2 Weeks

Semester Break

(b) 2nd Semester

Registration	-	1 Week

Lectures	-	15 Weeks
Examination	-	2 Weeks

(c) Long Vacation

i. Students Work Experience Programme (SWEP): 200 Level students-8 Weeks during the long vacation of the second year.
ii. Students' Industrial Work Experience Scheme (SIWES):400 Level students-24Weeks during the second semester and long vacation.

3.10. Registration Guidelines

i. Fresh students must come with originals of relevant documents to the faculty to collect admission letter and to be interviewed. Successful candidates would be informed of the procedure for registration with the Academic Office, the Faculty and the Department.
ii. Students should note the time and schedule of registration and be in possession of proper identification documents at all times.
iii. Students should consult with their advisors before filling the course registration form.
iv. Pre-requisite and/or co-requisite must be satisfied for courses that require such
v. All courses are registered at an officially designated center, except otherwise stated.
vi. Unrestricted electives chosen outside those listed must be approved by the department
vii. Minimum and maximum credit units registered for full time student is 15 and 24 units respectively.
viii. At registration, a student is required to pay the NACES student dues, and buy departmental publications and also settle other charges as may be required from time to time.
ix. Late registration, usually granted after normal registration period, attracts a penalty and does not last beyond a quarter of the semester period.
x. De-registration and registration of additional courses continues through the period of late registration.
xi. De-registration of research project, with consent of the supervisor, is not allowed beyond second semester registration period.

xii. Registration problems associated with ill health may be entertained.
xiii. If, as a result of ill-health, a student is likely to be late for registration, the department should be informed early enough and, upon resumption, supporting evidence(s) must be presented. Application for deferment must be made to/through the department, in time, for such request to be tendered for consideration by appropriate bodies.
xiv. A student is regarded as registered only when the necessary registration forms have been submitted to the departmental registration officer.
xv. A student who fails to register for two consecutive semesters shall be deemed to have voluntarily withdrawn from the course.

3.11. General Administration of Programme

The Head of Department (HOD), who is responsible for the over-all administration of the Department, is appointed by the Vice- Chancellor in each instance for a fixed period of time.

3.11.1 Administration of Students

a. Student Academic Advising
b. Apart from the open channel of communication between students and staff and the HOD, each student is allocated to an academic staff for academic counselling. A list of academic advisor/advises is normally published in the Department each session.
c. Handling of Academic Grievances
d. The department has a senior academic staff as the welfare officer. Each student has an academic staff as an adviser. Students have direct access to each of the Departmental staff and the Head of Department apart from the University's Dean of Students' Affairs. Student's grievances can thus be sorted out directly with individual staff. However, in the event of an unsatisfactory attention, students can take their grievances to the Head of Department who has a responsibility to take up the matter or discuss it at the Departmental meeting. Should the need arise, he may refer the matter to the Dean or the Faculty Board which may also make reference to Senate, in

case of a purely academic matter or to the Dean of students' Affairs in case of other matters.

4. DEPARTMENTAL STAFF

4.1. Academic Staff

S/No.	Name of Staff member	Rank	Qualifications
1	Prof. I. A. Madugu.	Professor	M.Eng., M.Sc., Ph.D., MNSE, MNMS, R. Engr. COREN
2	Prof. S.A Yaro	Professor	M.Sc.,Ph.D., MNSE, MNMS, COMEG,R. Engr. COREN
3	Prof. O. Aponbiede	Professor	M.SC, Ph.D., MNSE, MNMS, R. Engr. COREN
4	Prof. E.T. Dauda	Professor	B.Eng., M.Sc., Ph.D., MNSE, MNMS, R. Engr. COREN
5	Prof. R.A. Mohammed	Professor	B.Sc., M.Sc.,Ph.D, MNSE, MNMS, R. Engr. COREN
6	Prof. T. Ause	Professor	M.Sc., Ph.D,MNSE, MNMS
7	Prof. A. Kasim	Professor	B.Eng., M.Sc,Ph.D, MNMS R. Engr. COREN
8	Prof. M. Abdulmalik	Professor	B.Eng., M.Sc.,Ph.D, MNSE, MNMS, R. Engr. COREN
9	Prof. F. Asuke	Professor	B.Eng., M.Sc., Ph.D, MNMS R. Engr. COREN
10	Prof. T. D. George	Professor	B.Eng., M.Sc., Ph.D, MNMS, COMEG
11	Prof. U. Shehu	Professor	B.Sc., M.Sc., Ph.D, MNMS, R. Engr. COREN
12	Prof. K.A. Bello	Professor	B.Eng., M.Sc., Ph.D MNMS R. Engr. COREN
13	Dr. E.O.A Damisa	Reader	B.Sc., M.Sc., Ph.D, MNMS, COMEG
14	Dr. A.A. Adebisi	Reader	B.Eng., M.Sc., Ph.D MNMS, R. Engr. COREN
15	Dr. J. O. Gaminana	Reader	B.Eng., M.Sc., Ph.D MNMS
16	Dr. R. M. Dodo	Reader	B.Eng. M.Sc.,Ph.D. R. Engr. COREN
17	Gebi A. Ibrahim	Lecturer I	B.Eng. M.Sc.,
18	Dr. Usman Ibrahim	Lecturer I	B.Eng., M.Sc, R. Engr. COREN.
19	Dr. Zahraddeen Musa	Lecturer I	B.Eng. M.Sc.,
20	I.I. Abubakar	Lecturer I	B.Eng. M.Sc.,
21	Dr. A.A. Musa	Lecturer I	B.Eng. M.Sc., R. Engr. COREN
22	Abdullahi Ibrahim	Lecturer II	B.Eng. M.Sc.,
23	A. A. Muhammad	Asst. Lecturer	B.Eng.
24	U. L. Lawal	Asst. Lecturer	B.Eng.

25	Engr. U. A. Hassan	Lecturer I	B.Eng., M.Sc., SME, NMS, NSME, NMGS, COMEG, R. Engr. COREN

4.2. Non-Academic Staff (Technical)

S/No.	Name	Rank
1	Mr. E.O. Ochuokpa	Chief Technical Officer
2	Mr. Y. Mohammed	Chief Technical Officer
3	Mr. Abdulrauf Abdu	Chief Technical Officer
4	Mr. Garba Ibrahim Zamani	Chief Technical Officer
5	Mr. Y.M. Abdullahi	Chief Technical Officer
6	Mr. S. U. Mohammad	Chief Technical Officer
7	Mr. Shehu Aliyu Abubakar	Senior Technical Officer
8	Mr. Umar Abdullahi	Senior Technical Officer
9	Mr. Haruna Ahmad Aliyu	Senior Technical Officer
10	Mr. Umar Salmanu	Senior Technical Officer
11	Mr. Sani Mohammed	Senior Technical Officer
12	Mr. Adnan Usman Muhammad	Senior Technical Officer
13	Mr. David Zang	Senior Foreman
14	Y. M. Dauda	Senior craftsman
15	Suleiman Mustapha	Senior Craftsman
16	Aliyu Babangida	craftsman

4.3. Non-Academic Staff (Administrative)

S/No.	NAME	RANK
1	Salihu Yunusa	Senior Office Assistant
2	Mr. Mamuda Mohammed	Senior Office Assistant
3	Mr. A.B. Musa	Senior Chief Driver/Mechanic

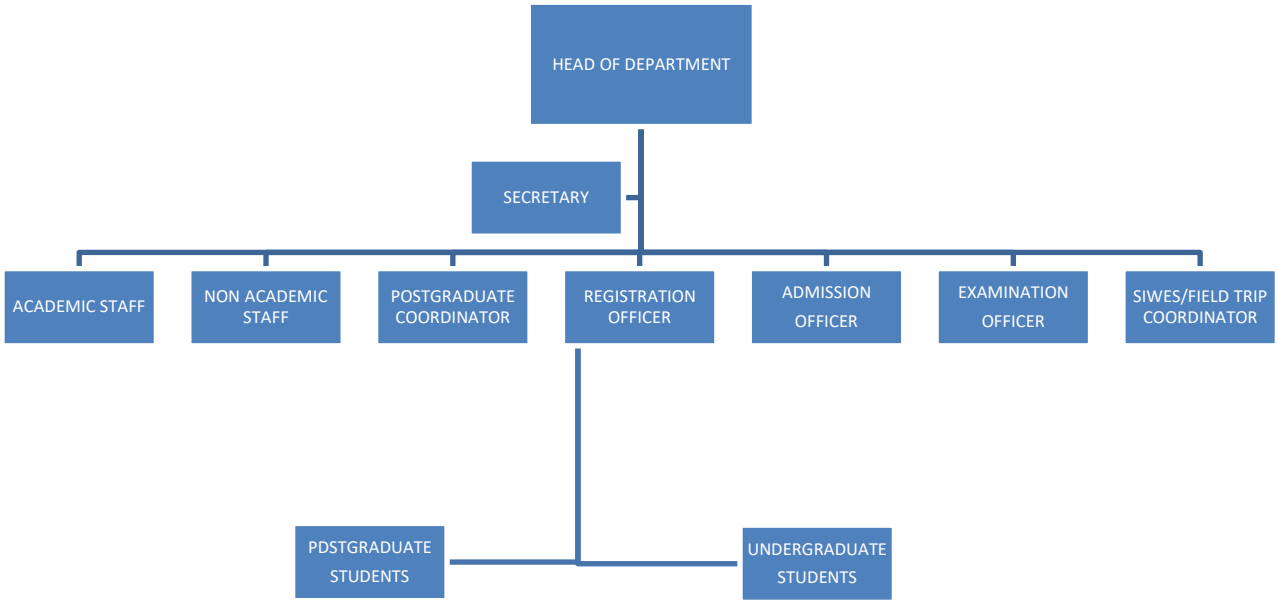

Figure 1: Organogram of the Department.