# ENUGU STATE UNIVERSITY OF SCIENCE AND TECHNOLOGY (ESUT)

## FACULTY OF ENGINEERING

## DEPARTMENT OF CHEMICAL ENGINEERING

# UNDERGRADUATE HANDBOOK

2022/2023

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# PREFACE

This handbook is designed to provide basic information to the students of Chemical Engineering Department; thus, providing the needed good foundation for seamless studies. It has been produced in line with the National Policy for Higher Education, including Council for the Registration of Engineering in Nigeria (COREN) and National Universities Commission (NUC) benchmark guidelines.

It is expected that the students will always refer to this handbook as well as the University's General Academic Regulations during course registration for each level of the study; thus, making possible the needed academic stead.

During your first year of study, you will observe that you will have relatively little contact with the Department because most of your lecturers will be provided by staff in the other faculties and departments through what is generally termed common universities and faculty courses.

There are numerous societies and clubs in the university catering for a wide variety of interests. Avoid secret societies and club. Join Christian and Professional societies. You are especially advised to register with the student chapter of the Nigerian Society of Chemical Engineering, where you will make contact with senior students of the department. This Society is involved in the organization of excursions and other related activities that are aimed at further educating the students about chemical engineering profession.

This handbook, although a source of information and an aid to orientation, cannot provide answers to all numerous challenges you may encounter. For this reason, students are assigned to staff advisers for counseling purpose. Know your academic adviser, consult him/her when necessary.

You are welcome to the Department

Engr. Dr. M. Omotioma

Head of Department

## ABOUT THE HANDBOOK

This undergraduate handbook should be used in conjunction with the University's General Academic Regulations. Information on certain services and functions of the university which may be helpful to you are described in detail in the University's General Academic Regulations, including:

**I. Academic Information**

Admission Requirement
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## BRIEF HISTORY OF THE UNIVERSITY

The Enugu State University of Science and Technology (ESUT) was originally founded as ASUTECH on July 30, 1980 by Law (cited as Law No.7 of 1980) enacted by the Anambra State House of Assembly. The enactment of the Law establishing the University was accompanied by other historical landmarks, among which were:

i. The appointment of the first president and chief Executive of the University, the Late Professor Kenneth Onwuka Dike.
ii. The inauguration of the first provision council of the University

iii. The admission of the first batch of the students.

These events culminated in the successful commencement of lectures at Enugu Campus. Professor Dike was in 1984 succeeded by Professor C. A. Onwumechili as the President of the University. The University was conceived as a multi-campus University, with its headquarters located at Enugu, the State Capital ,other campuses was located at Abakaliki, Akwa and Nnewi. But on account of logistic problems, only the Enugu and Akwa Campuses remained operational until 1987, when other two campuses was opened. There were only three faculties initially, namely:

1) Faculty of Engineering
2) Faculty of Science
3) Faculty of Technology

This arrangement was in keeping with the special mandate given to the University to undertake studies in all field of learning, while laying special emphasis on science, Applied Science and Technology. Prior to the rationalization of courses which took place in August, 1982, the two campuses of the University (i.e. Enugu and Akwa) offered identical programs with the result that the departments were duplicated in both campuses. However, consequent upon the rationalization made by the University Senate in August, 1982, and which was later approved by the then Provisional Council, faculties and departments were re-located between the two campuses as follows:

**FACULTYOF ENGINEERING**

| **ENUGU** | **AKWA** |
|---|---|
| (a) Civil Engineering | (a) Civil Engineering |
| (b) Electrical/Electronic Engineering | (b) Met. & Mat. Engineering |
| (c) Chemical Engineering | (c) Mech. (production) Engineering |
| (d) Mech. (production) Engineering | |

**FACULTY OF APPLIED BIOLOGICAL SCIENCES**

| | |
|---|---|
| (a) Applied Biology | (a) Food Science and Brewing |
| (b) Applied Biochemistry | (b) Industrial Microbiology |

**FACULTY OF APPLIED PHYSICAL SCIENCES**

| | |
|---|---|
| (a) Industrial Physics | (a) Applied Maths/Statistics |
| (b) Industrial Chemistry | (b) Geological Sciences |

The forgoing arrangement took effect from September ,1982 and subsisted until June 1985 when the academic programmes were expanded to include the following faculties: Education, Environmental science, Law and Management Sciences.

Sequel to an unsuccessful attempt to merge the University with the Institute of Management and Technology, Enugu, as a single entity in July 1985, the University Law of 1980 was replaced by the ASUTECH Edict. No. 20 of 1985, reaffirming among other things, the philosophy and objectives of the founding fathers of the university as well as its Four-Campus structure. The major impact of the 1985 Edict was as follows:

(i) Structurally, it returned the University governance to the traditional University system, with council and senate as main organs of governance and the Vice-Chancellor as the Chief Executive.

(ii) It reaffirmed the academic disciplines in the four campuses as follows:

| | |
|---|---|
| Enugu Campus | -Engineering/Technology and Management Sciences |
| Akwa Campus | -Basic & Applied sciences, Law and social Sciences |
| Abakaliki Campus | -Agricultural Science, including Aquaculture and Veterinary medicine |
| Nnewi Campus | -Health Sciences, including Medicine and Dentistry |

(iii)The establishment of the Interim Joint Council of ASUTECH/IMT with Professor C. Nwokolo as the chairman of the council. Following the rationalization of courses which the interim Joint Council undertook in early 1986, the Education Faculty collapsed and its constituent departments were relocated to other faculties, while Educational Foundations continued to offer service courses to these departments.

In November 1986, 1986, Akwa Campus of the University, which was closed in July 1985 after the IMT/ASUTECH merged was reopened. The IMT and ASUTECH became separate institutions once more and Prof. C. A. Onwumechili who resigned his appointment as the Vice-Chancellor, was replaced in December 1986 by Prof. Chiweyite Ejike. A machinery was set in motion in January, 1981 for the commencement of classes at the Abakaliki and Nnewi Campuses of the University. In February 1987, the two new campuses were officially opened with the induction of newly admitted pre-Science students.

In 1988,the then Visitor, Col. Robert N. Akonobi, ordered a visitation to the University and the major outcome was a restructuring of the University into four semi autonomous colleges, in Enugu, Akwa, Abakaliki and Nnewi, each headed by a deputy Vice-Chancellor and the other Principal officers at the University Headquarters played essentially coordinating roles.

Following the creation by the Federal Military Government, of Enugu State out of the former Anambra State, on 27th August, 1991: The headquarters of the Anambra State University of technology (ASUTECH) at Enugu and the Colleges of the University at Enugu and Abakaliki were constituted into the Enugu State University of Science and Technology by the Enugu State of Nigeria Edict No. 3 of 1991. At the same time, the college of Health Sciences were established in Adada, Nkpologu (Nsukka) and Abakaliki respectively. The Faculties of Law and Education and the Institute of Education were also established in Enugu. The Enugu State University of Science and Technology retained the headquarters, existing staff and students, and the logo of the former ASUTECH. The University's motto remained 'Technology for Service' and the aims and objectives of the founding fathers remained unchanged. The four colleges of the University, each headed by a provost were as follows:

(i) The college of Engineering and Technology, Enugu.
(ii) The college of Agricultural Sciences, Abakaliki.
(iii)The College of Applied Natural and Social Sciences, Adada, Nkpologu, Nsukka.
(iv)The College of Health Sciences, Abakaliki.

With the creation of Ebonyi State and the subsequent transformation of the Colleges of Agriculture and Medicine in Abakaliki into full-fledged University, the Enugu State University of Science and Technology Colleges of Agriculture and Medicine were relocated to Enugu. the inception of democratic governance in 1999 impacted positively on the University's rapid infrastructural development following the College of Medicine and the permanent site. In 2006, the University administration, the main library and six Faculties (Agriculture, Environmental Sciences, Education, Applied Natural Sciences, Law and Social Sciences) moved to the permanent site at Agbani. The Pre-Science programme which has been re-designated Pre-Degree is still at Nsukka and the Faculties of Management Sciences and Engineering had moved to the permanent site at Agbani in 2018 and 2021 respectively.

## CHEMICAL ENGINEERING PROFESSION

### Introduction

Chemical Engineering is that branch of engineering profession which deals with the manufacture (on an industrial scale) of useful products from raw material by suitable applications of controlled chemical and physical processes. It utilizes the basic principles of mathematics, physics and chemistry. It is closely allied with and considerably overlaps such other branches as

mechanical, ceramic, petroleum, metallurgical and food engineering. The practice of the profession is therefore developed from a combination of these areas with other specialized branches of the applied biological physical and social sciences

**Philosophy and Objectives**

**Philosophy**

The general philosophy is to produce graduates with high academic standard and adequate practical background for self employment as well as being of immediate value to the industry and community in general.

To achieve the specific goals and objectives of the national policy on industrialization and self-reliance, the Department's programme is geared towards:

i. The development of a thorough practice in engineering and technology training
ii. Broad-based training in Chemical Engineering at the early stages of the programme
iii. Practical application of Chemical Engineering and manufacturing processes
iv. Adequate training in human and organizational behavior and management.
v. Introduction to entrepreneurial education and training
vi. Close association of the programme with industries in the country

**Objectives**

The principal objective of the Department is the production of engineers who are capable of meeting challenges in the Nigerian chemical industries. It also emphasizes a sound knowledge of engineering principles, coupled with a high practical and innovative ability to shoulder a broad spectrum of engineering

responsibilities. To this end, the courses offered in the Department are designed to provide the educational training and skills necessary for understanding, planning, designing, operating and maintaining various processes and operations involved in modern chemical industries.

In addition to the teaching programmes, the Department encourages research development work by students and the academic staff. This area is taken very serious by this department in view of our present economic problems and lack of maintenance of sophisticated machines from overseas dumped in this country. Students are therefore encouraged to develop indigenous chemical process which are appropriate for our specific needs and environment and which utilize our natural materials and resources. They are likewise encouraged to design, assemble and construct equipment needed for their research projects. Emphasis is placed on the construction of pilot plant and mini-pilot plant scale equipment in order to afford students the opportunity to work with units which approximate those used in the industry. Due to current economic trend, specialized courses as Petroleum Refining, Coal Technology, Petrochemicals, Environmental

Pollution and Control (Environmental Engineering) etc., usually taught as electives are scheduled as regular courses.

**Job Opportunities**

The present economic problem favours the employment of graduate engineers. This is because emphasis is now shifted from knock-down components to local manufacture, which is the domain of chemical engineering. Apart from this, opportunities abound for graduate of chemical engineers in the manufacture of chemicals, petroleum products, rubber and plastics, paper and pulp, gas and ceramics, metal and textiles. Chemical engineers are also required in food processing industries, breweries, wood processing, biochemical industries, environmental control (including effluent treatment, sewage disposal and water resource management) , banks and insurance for project evaluation and appraisal. Furthermore, in view of the expected growth in the refineries, petrochemical plant, natural gas utilization and the steel industry, job opportunities for chemical engineers graduates will continue to be numerous.

**Degree Programme Offered**

The department offers a B. Eng Degree Programme in chemical Engineering. The programme extends over five-year period. The courses taken in the first and second semester years are the same for all the departments in Faculty of Engineering. Specialization in Chemical Engineering starts in the third year of the programme. The second semester of the fourth year is devoted solely to industrial training, which is an essential requirement for the B. Eng. Degree.

**Areas of Specialization and Research Activity**

The following are the areas of specialization offered by the department. These areas correspond to those in which research activities are channeled in the Department:

Unit Operation, Chemical Reaction Engineers, Chemical Process Development, Coal and Energy Conversion Technology, Biochemical Engineering, Nuclear Engineering. Computer Aided Design and Stimulation, Chemical Engineering Analysis, Petroleum Refining and Petrochemicals, Polymer Science and Technology (Polymer Engineering), Project Appraisal, and Evaluation, Environmental Pollution and Control (Environmental Engineering).

**Admission Requirements:**

**(a) General**

A candidate seeking admission must have credit level passes in five subjects in either the West African School Certificate (WASC) Examination or the General Certificate of Education (GCE) , Ordinary level, NECO and NABTEB in not more than two sittings. In addition, the candidate must have at least a credit pass in English Language and Mathematics.

**(b) Faculty/Department**

To qualify for the faculty and the departmental admission,a candidate must have credit passes in Mathematics, Physics and Chemistry.

**(c)** Candidates who satisfy the requirements detailed above may be admitted into the department after passing the University Matriculation Examination (UME) and Post University Matriculation Examination (PUTME).

**(d) Direct Entry**

Candidates who satisfy the requirements detailed above and in addition have passed Mathematics, Physics and Chemistry in not more than one sitting in Advanced Level (G. C. E) may be admitted into the department by direct entry. Candidates with other qualifications recognized by the University for the purpose of direct entry admission may also apply. Candidates admitted by direct entry admission would normally follow the four-year programme.

**Minimum Duration**

The minimum duration of the programme is five academic sessions for candidates with 'O' level qualifications, while candidates with 'A' level or its equivalent will spend minimum of four academic sessions, provided that they satisfy all other University requirements. Candidates with relevant HND, Bachelor's degree or their equivalents will spend a minimum of three sessions depending on class of the certificate.

**Graduation Requirement**

**Degree Classification**

The determination of the class of degree is based on the cumulative Grade Point Average (CGPA) earned at the end of the programme. The CGPA is computed by dividing the total number of credit points (TTP) by the total number of units (TTC) for all the courses taken in the semester. The CGPA is used in the determination of the class of degree as summarized in table 1 below.

**Table 1: Degree Classification**

| CUMULATIVE GRADE POINT AVERAGE(CGPA) | CLASS OF DEGREE |
|---|---|
| 4.50-5.00 | First class (Hons) |
| 3.50-4.49 | 2nd class Upper (Hons) |
| 2.40-3.49 | 2nd class Lower (Hons) |
| 1.50-2.39 | 3rd class (Hons) |
| 1.00-1.49 | Pass |

## EXAMINATION OFFENCES AND THEIR PUNISHMENT/ PENALTY

| | OFFENCES | PUNISHMENT |
|---|---|---|
| A | i) Assault of an invigilator<br>ii) Involvement in alteration of grades<br>iii) Being in possession of dangerous weapon in and around examination venue(in addition, the student should be handed over to the police)<br>iv) Impersonation when the impersonator is not a student of ESUT, he or she should be handed over to the police and if he or she is from another tertiary institution and his particulars are known, he or she should be reported to his or her institution | Expulsion from the university. |
| B | i) Involvement in examination leakage<br>ii) Destruction of evidence relevant to the case<br>iii) Smuggling already prepared answer scripts into the examination hall | Three (3) years suspension. |
| C | i) Being in possession of materials relevant to the examination.<br>ii) Refusal to surrender exhibit in connection with the examination offence.<br>iii) Snatching of answer scripts from another student.<br>iv) Writing solutions on any part of the part of the body or cloths.<br>v) Use of calculators (or phones) to store solutions relevant to the solutions. | Three (3) years suspension for second offender and two (2) for first offender. |
| D | i) Smuggling out answer script from exam hall.<br>ii) Smuggling out examination questions from exam hall.<br>iii) Exchange of answer scripts during an examination for the partners<br>iv) Failure/Refusal to summit answer scripts after examination | Three (3) years suspension for second offender and two (2) years suspension for first offender. |
| E | i) Writing solution on any part of the question paper<br>ii) Exchange of question paper with solutions written on any part of them.<br>iii) Cheating by peeping into another person's work during examination<br>iv) Displaying one's work for another to copy from<br>v) Talking to or with another student during examination<br>vi) Disobeying the invigilator during an examination e.g., refusal to relocate, refusal to sign in and undue delay in submitting answer script at the end of the examination.<br>vii) Creating disturbances during the examination, e.g. shouting slogan, shuffling feet unduly, whistling, fighting (both partners), assaulting another student, causing panic, e .t .c.<br>viii) Unjustified verbal attack on the invigilator | One (1) year suspension for second offender and being made to fail examination for the first offender |

**COURSE DESCRIPTIONS**

**100-LEVEL**

**FIRST SEMESTER**

| Course Code | Course Title | Credit Unit |
|---|---|---|
| GST 111 | Communication in English I | 2 |
| GST 113 | Nigeria Peoples and Culture | 2 |
| GST 121 | Use of Library, Study Skills & ICT | 2 |
| ICH 111 | General Chemistry I | 3 |
| ICH 197 | General Practical Chemistry I | 1 |
| PHY 111 | General Physics I | 3 |
| PHY 197 | General Practical Physics I | 1 |
| MAT 111 | Elementary Mathematics | 3 |
| CEE 121 | Computer Programming | 3 |
| | **Total** | 20 |

**100-LEVEL**

**SECOND SEMESTER**

| Course Code | Course Title | Credit Unit |
|---|---|---|
| GST 112 | Communication in English II | 2 |
| GST 114 | Social Sciences | 2 |
| GST 118 | Peace Studies & Conflict Resolution | 2 |
| ICH 112 | General Chemistry II | 3 |
| ICH 198 | General Practical Chemistry II | 1 |
| PHY 112 | General Physics II | 3 |
| PHY 198 | General Practical Physics II | 1 |
| MEC 122 | Basic Engineering Drawing | 2 |
| MME 122 | Engineering Materials | 3 |
| MAT 112 | Elementary Mathematics II | 3 |
| | **Total** | 20 |

**200-LEVEL**

**FIRST SEMESTER**

| Course Code | Course Title | Credit Unit |
|---|---|---|
| EEE 221 | Applied Electricity I | 3 |
| MEC 223 | Engineering drawing I | 2 |
| CHE 225 | Fundamentals of Fluid Mechanics | 3 |
| CVE 227 | Applied Mechanics | 3 |
| FEG 227 | Engineering Mathematics I | 3 |
| FEG 221 | Engineer in Society | 2 |
| CEE 221 | Introduction to Modeling and Simulation | 2 |
| FEG 293 | General Engineering Laboratory Course | 1 |
| | **Total** | 19 |

**200-LEVEL**

**SECOND SEMESTER**

| Course Code | Course Title | Credit Unit |
|---|---|---|
| ENS 222 | Introduction to Entrepreneurship | 2 |
| EEE 222 | Applied Electricity II | 3 |
| MEC 224 | Engineering Drawing II | 2 |
| FEG 294 | Student Workshop Experience | 1 |
| CHE 226 | Fundamentals of Thermodynamics | 3 |
| CVE 228 | Strength of Materials | 3 |
| FEG 228 | Engineering Mathematics II | 3 |
| FEG 290 | SIWES | 2 |
| | **Total** | 19 |

**300-LEVEL**

**FIRST SEMESTER**

| Course Code | Course Title | Credit Unit |
|---|---|---|
| ENS 311 | Entrepreneurship Practicum | 2 |
| FEG 321 | Engineering Mathematics III | 2 |
| CHE 301 | Process Instrumentation | 2 |
| CHE 331 | Transport Phenomena I (Heat Transfer) | 2 |
| CHE 333 | Transport Phenomena II (Mass Transfer) | 2 |
| CHE 335 | Particle Technology | 2 |
| CHE 341 | Chemical Thermodynamics I | 2 |
| CHE 351 | Chemical Reaction Engineering I | 2 |

| | | |
|---|---|---|
| CHE 361 | Introduction to Material & Energy Balances / Chemical process principle | 2 |
| CHE 391 | Chemical Engineering Laboratory I | 2 |
| | **Total** | 20 |

**300-LEVEL**

**SECOND SEMESTER**

| **Course Code** | **Course Title** | **Credit Unit** |
|---|---|---|
| FEG 322 | Engineering Mathematics IV | 2 |
| FEG 390 | SIWES II | 3 |
| CHE 332 | Separation Process I | 2 |
| CHE 352 | Chemical Reaction Engineering II | 2 |
| CHE 362 | Process Simulation and Statistics for Physical Science & Engineering | 2 |
| CHE 364 | Chemical Process Design and Evaluation I | 2 |
| CHE 380 | Polymer Process Engineering | 2 |
| CHE 382 | Biochemical Engineering I | 2 |
| CHE 392 | Chemical Engineering Laboratory II | 2 |
| | **Total** | 19 |

**400-LEVEL**

**FIRST SEMESTER**

| **Course Code** | **Course Title** | **Credit Unit** |
|---|---|---|
| CHE 407 | Chemical Engineering Analysis | 2 |
| CHE 435 | Separation Process II | 2 |
| CHE 437 | Transport Phenomena III | 2 |
| CHE 443 | Chemical Engineering Thermodynamics III | 2 |
| CHE 405 | Chemical Process Dynamics and Control | 2 |
| CHE 465 | Chemical Process Design and Evaluation II | 2 |
| CHE 471 | Chemical Process Economics | 2 |
| CHE 485 | Chemical Technology | 2 |
| CHE 483 | Engineering Elective (Environmental Pollution & Control) | 2 |
| CHE 493 | Chemical Engineering Lab III | 2 |
| CHE 496 | Technical Writing | 1 |
| | **Total** | 19 |

**400-LEVEL**

**SECOND SEMESTER**

| Course Code | Course Title | Credit Unit |
|---|---|---|
| FEG 490 | SIWES III (Industrial Attachment) | 6 |

**500-LEVEL**

**FIRST SEMESTER**

| Course Code | Course Title | Credit Unit |
|---|---|---|
| CHE 501 | Loss Prevention in Process Industries | 2 |
| CHE 539 | Separation Process III | 2 |
| CHE 567 | Chemical Plant Design | 2 |
| CHE 573 | Engineering Management I | 2 |
| CHE 581 | Petroleum Refining and Process | 2 |
| CHE 583 | Coal Utilization & Processing Technology | 2 |
| CHE 597 | Technical Communication (Seminar) | 2 |
| CHE 585 | Electives (Reservoir Engineering) | 2 |
| CHE 599 | Research project | 3 |
| | **Total** | 19 |

**500-LEVEL**

**SECOND SEMESTER**

| Course Code | Course Title | Credit Unit |
|---|---|---|
| CHE 502 | Chemical Process Optimization | 2 |
| CHE 554 | Chemical Reaction Engineering III | 2 |
| CHE 567 | Chemical Plant Design | 2 |
| CHE 574 | Engineering Management II | 2 |
| CHE 582 | Petroleum Processing and Technology/Petrochemicals | 2 |
| CHE 584 | Energy Conversion Technology | 2 |
| CHE 586 | Biochemical Engineering II | 2 |
| CHE 588 | Polymer Science & Technology/Engineering | 2 |
| CHE 599 | Research Project | 3 |
| | **Total** | 19 |

## COURSE CONTENT SPECIFICATIONS/SYLLABUS

### 100 LEVEL COURSES

**GST 111: Communication in English I (2 Units)**

Effective communication and writing in English Language skills, easy writing skills (organization and logical presentation of idea, grammar and style), comprehension, sentence construction, outlines and paragraphs.

**GST 121: Use of Library, Study Skills and ICT (2 Units)**

Brief history of libraries; library and education, University libraries and other types of libraries, study skills (reference services); Types of Library materials, using library resource including e-learning, e-materials, etc., ; understanding library catalogues (card, OPAC, etc.,) and classification; copyright and its implications; Database resources; Bibliographic citations and referencing. Development of modern ICT; Hardware technology; Software technology; Input devices; storage devices; output devices; communication and internet services; word processing skills (typing etc.)

**GST112: Communication in English II (2 Units)**

Logical presentation of papers; phonetics; Instruction on lexis; Art of publics peaking and oral communication; figures of speech; précis; Report writing.

**GST 118: Peace and Conflict Resolution (2 Units)**

Basic concepts in peace studies and conflict resolution; peace as vehicle of unity and development; conflict issues; Types of conflict, e.g., Ethnic/religious/political/economic conflicts, Root causes of conflict and violence in Africa; Indigene/settler phenomenon; peace-building, management of conflict and security. Elements of peace studies and conflict resolution, developing a culture of peace; peace mediation and peace-keeping; Alternative dispute resolution (ADR). Dialogue/arbitration in conflict resolution; Role of international organizations in conflict resolution e.g., ECOWAS, Africa Union, United Nations, etc.,

**MEC 122: Basic Engineering Drawing (2 Units)**

Introduction to Engineering Drawing as a means of communication. Drawing paper format. Use of drawing instruments. Types of lines sand their uses in Engineering Drawing. Circles and tangent. Circles to satisfy conditions involving other circles, lines and points. Conic sections, various methods of their construction.

Cycloid, epi and hypocycloids. Involute. Archimedes spiral. Loci: the helix (cylindrical and conical) single and multi-start threads. Coiling of compression and tension springs. Loci-Paths of points on moving link work. The theory of projection. Perspective (briefly), parallel projections (oblique general, cavalier, cabinet). (Orthographic-Multi-view, two views, three views, auxiliary views). (Axonometric-Isometric, diametric, trimetric). Multi view

representation. 1st and 3rd angle representations. Isometric drawing. Oblique drawings. Revisions.

**ICH 111: General Chemistry I (3 Units)**

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

**ICH 112: General Chemistry II (3 Units)**

History survey of the development and importance of Organic chemistry, electronic theory in organic chemistry. Isolation and purification of organic compound. Determination of structures of organic compounds including qualitative and quantitative analysis inorganic chemistry. Nomenclature and functional group classes of organic compounds. Introductory reaction mechanism and kinetics. Stereo chemistry. The chemistry of alkanes, alkenes, alkynes, alcohols, ethers, amines, alkylamines, nitriles, aldehydes, ketones, carboxylic acids and derivative. The chemistry of selected metals and non-metals. Comparative chemistry of groups 1A, IIA and IVA elements. Introduction to transition metal chemistry.

**ICH 197: General Practical Chemistry I (1 unit)**

Laboratory experiments designed to reflect the topics taught in ICH 112 and ICH 111 such as qualitative and quantitative chemical analysis, acid-base titrations. Gravimetric analysis. Calculation, data analysis and presentation. Functional group analysis.

**ICH 198: General Practical Chemistry II (1 Unit)**

Continuation of laboratory experiments designed to reflect the topics taught in ICH 111 and IC 112. Some of the experiments will have been carried out in ICH 117.

**MAT 111: Elementary Mathematics I (3 Units)**
**(Algebra and Trigonometry)**

Elementary set theory, subsets, union, intersection, complements, Venn diagrams. Real members, integers, rational and irrational numbers. Mathematical induction, real sequences and series, theory of Quadratic equations, Binomial theorem, complex numbers, algebra of complex numbers, the Argand diagram. De-Moire's theorem, in throats of unity. Circular measures, trigonometric functions of angles of any magnitude, addition and factor formulae.

**MAT 112: Elementary Mathematics II (3 Units)**
**(Calculus)**

Functions of a real variable, graphs, limits and idea of continuity. The derivative, as limit of rate of change. Techniques of differentiation, maxima and minima. Extreme curve sketching,

integration, Definite integrals, reduction formulae, application to areas, volumes (including approximate integration. Trapezoidal and Simpon's rule).

**PHY 111: General Physical 1 (3 Units)**
**(Mechanics, Thermal Physics and Waves)**
Space and Time, Units and Dimension, kinematics, fundamental Law of mechanics, statics and dynamics, work and energy, conservation laws. Moments, and energy of rotation; simple harmonic motion, motion of simple system, elasticity; Hooke's law. Young's shear and bulk moduli, Hydrostatics; pressure; buoyance, Archimedes' principles, surface tension; adhesion cohesion, capillarity, drops and bubbles, Temperature, heat, gas, law, laws of thermodynamics; kinetic theory of gases; sound. Types and properties of waves as applied to sound and light energies. Superposition of waves. Propagation of sounding gases, solid and liquids and their properties. The unified spectra analysis of waves. Applications.

**PHY 112: General Physics II (3 Units)**
**(Electricity, Magnetism and Modern Physics)**
Electrostatics; conductors and currents; dielectrics, magnetic fields and electro-magnetic induction; Maxwell's equations; electromagnetic oscillations and waves; coulomb's law; methods of charging; ohm's law and analysis of DC circuits; AC voltages applied to inductors, capacitors and resistance. Applications.

**PHY 197: General Practical Physics I (1 Unit)**
Introductory course emphasizes quantitative measurements, the treatment of measure errors, and graphical analysis. A Variety of experimental techniques will be employed. The experiments include studies of meters, the oscilloscope, mechanical systems, electrical and mechanical resonant systems, light, heat, viscosity, etc., covered in PHY 111 and PHY 112. However, emphasis should be place on the basic physical techniques for observation, measurements, data collection, analysis and deduction.

**PHY 198: General Practical Physics II (1 Unit)**
This is a continuation of the experiments designed for PHY 111 and PHY 112 some of which have been covered under PHY 197.

**CEE 121: Computer Programming (3 Units)**
Introduction to computers and computing problems solving on computer algorithms, design using flowchart and pseudo-code. Introduction to high level programming languages. Basic and FORTRAN syntax, flow of control, input/output constructs, data types. Programming in FORTRAN. Extensive exercises in solving engineering problems using flowchart and pseudo-code.

**MME 112: Engineering Materials (3 Units)**
Introduction to electronics configuration, atomic structures, inter-atomic bonding mechanisms, crystal and microstructure. Relationship between structure and properties of metals, alloys,

ceramics and plastics. Principles of eh behavior of materials in common environments. Fabrication processes and applications.

## 200 LEVEL COURSES

**ENS 222: Introduction to Entrepreneurship (2 Units)**

Introductory entrepreneurial skills. Relevant concepts: Enterprise, entrepreneur, entrepreneurship, Business, Innovation, Creativity, Enterprising and entrepreneurial attitude and behavior. History of entrepreneurship in Nigeria. Rationale for entrepreneurship, creativity and innovation for entrepreneurs. Leadership and entrepreneurial skills for coping with challenge. Unit operations and time management. Creativity and innovation for self-employment in Nigeria. Overcoming job creation.

Challenges. Opportunities for entrepreneurship, forms of businesses, staffing, marketing and the new enterprise. Feasibility studies and starting a new business. Determining capital requirement and raising capital. Financial planning and management. Legal issue, insurance and environmental consideration. Also, to be incorporated, on the other side of the spectrum, are employability, skills-interview techniques, oral presentation skills, etc.,

**EEE 221: Applied Electricity I (3 Units)**

Fundamental concepts-electric field, charges, magnetic fields. Current B-H curves Kirchhoff's laws, superposition. The venin, Norton theorems, Reciprocity, RL, RC RLC circuit. DC, AC bridges, Resistance, capacitance, inductance measurement, transducers, single phase circuits, complex J-notion, AC circuits, impedance, admittance, subscription.

**EEE 222: Applied Electricity II (3 Units)**

Basic machine – DC, synchronous alternators, transformers, equivalent circuits. Three phase balanced circuits, PN junction Diode, transistors, thyristors FRTs, Zener, Rectifiers. Basic control systems, open/close loop systems. Communications fundamentals, introduction of TV, Radio Telephone systems.

**MEC 223: Engineering Drawing I (2 Units)**

Revision of multi-view representation. Harder examples on two and three view representation ($1^{st}$and $3^{rd}$ Angles). Harder examples on isometric drawing to include simple pictorial assembly drawing in isometric. Harder examples on oblique drawing (Cavalier, Cabinet and Angles other than 45 degrees). Dimensioning. Sections and conventions. Auxiliary views. Representation and specification of threads. Bolted joints. Keys and cottered joints. Conventional representations (see BS 308).

**MEC 224: Engineering Drawing II (2 Units)**

Further works on projections; projection of points, lines, planes and solids. Intersections of solids. Cams. Interpretation of solids. Development of surfaces. Detail drawing belts, chains, gears, bearing and lubrication arrangements. Couplings brake, flexible shafts, universal joints, etc. assembly drawings. Revisions

**FEG 294: Student Workshop Experience (1 Unit)**

Introduction to practical and skills in general engineering through instruction in operation of hand and powered tools wood and metal cutting and fabrication. Supervised on experience in safe usage of tools and machines for selected tasks.

**CHE 225: Fundamental of Fluid Machines (2 Units)**

Properties of fluids, fluids statics conservation laws, friction effects and losses in laminar and turbulent flows ducts and pipes. Dimensional analysis and dynamic similitude, principles of construction and operation of selected hydraulic machinery. Hydro power systems.

**CEE 221: Introduction to Modeling and Simulation (2 Units)**

Introduction to computers and computing problems solving on computer algorithms, design using flowchart and pseudo-code. Introduction to high level programming languages. Basic and FORTRAN syntax, flow of control, input/output constructs, data types. Programming in FORTRAN. Extensive exercises in solving engineering problems using flowchart and pseudo-code.

**CHE 226: Fundamental of Thermodynamics (2 Units)**

Basic concepts, quantitative relations of Zeroth, first, second and third laws of thermodynamics. Behavior of pure substances and perfect gases. Ideal gas cycles.

**CVE 227: Applied Mechanics (2 Units)**

Forces, moments, couples. Equilibrium of simple structures and machines parts. Friction. First and second moments of area; centroids. Kinematic of particles and rigid bodies in plane motion. Newton's laws of motion. Kinetic energy and momentum analysis.

**CVE 228: Strength of Materials (2 Units)**

Consideration of equilibrium, composite members, stress-strain relation. Generalized Hooke's law. Stresses and strains due to loading and temperature changes. Torsion of circular members. Shear force, bending moments and bending stresses in beams with symmetrical and combined loadings. Stress and strain transformation equations and Mohr's circle elastic buckling of columns.

**FEG 221: Engineering in Society (2 Units)**

Philosophy of science and engineering. History of engineering and technology. The engineering profession-engineering-engineering literacy professional bodies and engineering societies. Engineer's code of conduct and ethics. Engineers and nation building economy, politics, business, safety in Engineering and introduction in Risk analysis, invited lecturers from professionals.

**FEG 227: Engineering Mathematics I (3 Units)**

Limits, continuity, differentiation, introduction to linear first order differential equations, partial and total derivatives, composite functions, matrices and determinants, vector algebra, vector calculus, directional derivatives.

**FEG 228: Engineering Mathematics II (3 Units)**

Second order differential equations, line integral multiple integral and their applications, differentiation of integral. Analytical functions of complex variables. Transformation and mapping. Special functions.

**FEG 293: General Engineering Laboratory Course (1 Unit)**

Laboratory investigation and report submission for selected experiments and projects in Thermodynamics, Applied Mechanics and Applied Electricity and Fundamental of fluid mechanics.

**FEG 290: Students Industrial Work Experience (SIWES I) (2 Units)**

On the job experience in industrial chosen of practical working experience but not necessarily limited to the student's major (8 weeks during the long vacation following 200 level).

## 300 LEVEL COURSES

**ENS 311: Entrepreneurship Practicum (2 Units)**

Profiles of business ventures in the various business sectors such as: Soap/Detergent, Toothbrush and Toothpaste making; photography; Brick making; Rope making, Brewing; Glassware production/ceramic production, paper production; water treatment/ conditioning/ packaging; food processing/ preservation/packaging, metal fabrication, training industry; vegetable oil extraction; farming; fisheries/aquaculture; plastic making; refrigeration/Air-conditioning; carving, weaving, bakery; tailoring, printing, carpentry, interior decoration, animal husbandry etc. case study methodology applied to the development and administration of cases that bring out key issues of business environment, start up, pains and gains of growth of businesses, etc. with particular reference to Nigerian businesses. Experience sharing by business actors in the economy with students during case presentations.

**FEG 321: Engineering Mathematics III (3 Units)**

Linear Algebra. Elements of matrices. Determinants, inverses of matrices theory of linear equations, eigen values and eigen vectors. Analytical geometry, coordinate transformation, solid geometry, polar, cylindrical and spherical coordinates, elements of functions of several variables, surface variables. Ordinary integrals, evaluation of double integrals, triple integrals, line integrals and surface integrals. Derivation and integrals of vectors. The gradient of scalar quantities. Flux of vectors, the curl of vectors, field, Gauss, Greens and Stroke's theorems and applications. Singular values functions. Multi valued functions, analytical functions, Cauchy Riemann's singularities and Zeroes, Contour Integration including the use of Cauchy's integral theorems, Bilinear Transformation.

**CHE 301: Process Instrumentation (2 Units)**

Measuring instruments for level, pressure, flow, temperature and physical properties. Chemical composition analysers. Measurement. Gas chromatograph. Mass Spectrometer. Sampling systems.

**CHE 331: Transport Phenomena I (Heat Transfer) (2 Units)**

Compressible flow: Normal shockwaves. Non-Newtonian fluids. Radiation: Mechanism of radiative heat transfer. Heat exchange between radiating surfaces. Unsteady state conduction. Free and forced convective heat transfer. Determination of heat transfer coefficients. Application to design of heat exchanges. Diffusion of vapours. Diffusion in liquids and solids.

**CHE 333: Transport Phenomena II (Mass Transfer) (2 Units)**

Boundary layer theory and turbulence. Navier-Stokes equations. Universal Velocity profile. Condensation and boiling. Eddy diffusion. Theories of mass transfer. Mass transfer with chemical reaction. Inter-phase mass transfer.

**CHE 335: Particle Technology (2 Units)**

Properties of particles. Motion of particles in a fluid, Stroke's and Newton's Laws. Flow through packed beds. Fluidization. Sedimentation and flocculation. Filtration. Screening, Classification and grinding.

**CHE 341: Chemical Engineering Thermodynamics I (2 Units)**

Cycles, Carnot; thermodynamic Turbines Seamand Gas, Refrigeration; General P-V-T Relations. The P-V-T behaviour of pure substances; Equation of state for gasses; the principle of corresponding state; Compressibility relations; reduced pressure; reduce volume; temperature; pseudo critical constants. P-V-T approximations for gaseous mixture ideal gas mixtures. Dalton's law of additive pressure; Amagat's law of additive volumes; Pseudo critical point method; Kay's rule, Gilliland's method; Behaviour of liquids. Heat Effects. Heat capacities as a function of temperature, specific heats of liquids and solids; Heat effects accompanying phase change Clausius-Clapeyron equation, standard heats of reaction formation and combustion effect of temperature on heat reaction. Heat of mixing and solution, Enthalpy concentration diagrams

for $H_2SO_4$, $H_20$, etc., partial enthalpies, single and multiple effect evaporators with regards to heat effects. Thermodynamics of Flow Processes. Fundamental equations, continuity equation; equation of motion; energy equation; Bernoulli's equation; Flow in pipes, laminar and turbulent flows; Reynolds number, friction factor. Fanning equation; Flow meter, Nozzles; Compressors single stage and multistage, effect of Clearance.

**CHE 351: Chemical Reaction Engineering I (2 Units)**

Measurement and analysis of wreathing reaction. Homogeneous reactions. Catalysis. Chain reactions. Kinetics of heterogeneous and catalytic reactions. Photochemistry. Absorption of gases on solids. Application to gas chromatography.

**CHE 361: Introduction to Material & Energy Balances/ Chemical Process Principles (2 Units)**

Units and dimensions. The mole unit. Conventions in the method of analysis and measurement. Temperature. Pressure. Physical and chemical properties and measurement. Techniques of solving problems. The chemical equation stoichiometry, material balances. Program of analysis of material balances. Program of analysis of material balances problem, problems with direct solutions. Material balances using algebraic techniques control surface and stage balances for open and closed system. Problems involving components (elements). Recycle, Bypass, Purge; Effect of recycle and purge on mass and energy balances. Gases, vapours, liquid and solids. Ideal gas law, Real gas relationships. Vapour pressure. Saturation. Partial saturation and humidity. Material balanced involving condensation and vaporization phase phenomena. Energy balances. Concepts and Units. Heat capacity. Calculation of enthalpy changes without change phase. Enthalpy for phase transition. General Energy balance. Reversible process the mechanical energy balance. Heat of reaction. Heat of solution and mixing combine material and energy balances; Application fundamental concept of mass and energy balances and mass transfer to unit operation in distillation. Simultaneous use of material and energy balances for the steady state. Enthalpy concentration chart. Humidity chart and their use. Complex problems; Lever rule Geometrical construction for mass. Energy balances for adiabatic and non-adiabatic process. Unsteady state material and energy balances.

**CHE 391: Chemical Engineering Laboratory I (2 Units)**

Laboratory experiments in transport phenomena. Kinetics and separation process.

**FEG 322: Engineering Mathematics IV (3 Units)**

Series solution of second order linear differential equations with variable coefficients. Bassel and Legnedre equations. Equations with variable coefficients. Sturn-Louville boundary value problems. Solutions of equations in two and three dimensions by separation of variables. Eigen partial differential equations and linear integral equations. Integral transform and their inverse including; Fourier, Laplace, Mellin and Handel Transforms. Convolution integrals and Hibbert transforms. Calculus of finite differences. Interpolation formulae. Finite difference equation.

Runge Kutta and other methods in the solutions of ODE and PDEs. Numerical integration and differentiation.

**FEG 390: Students Industrial Work Experience II (SIWES II) (3 Units)**
On the job experience in industrial chosen for practical working experience but not necessarily limited to the student's major (12 weeks during the long vacation following 300 level).

**CHE 332: Separation Process I (2 Units)**
Stage-wise and continuous contact equipment. Isothermal gas absorption. Binary distillation. Leading. Hydrodynamics of packed and plate columns.

**CHE 352: Chemical Reaction Engineering II (2 Units)**
Types of reactions, Reaction rate, variables determining reaction rate; Arrhenius rate expressions from postulated mechanisms; interpretation of batch reaction data. Integral and differential methods of analysis, Reversible, parallel, series, autocatalytic reactions, Optimization of output and yield from reactor, Comparison of various performances (PRR, CSIR, BR), Photochemistry.

**CHE 362: Process Simulation and Statistics for Physical Science & Engineering (2 Units)**
Introduction to process simulation using the HYSYS software or any other process simulation software. Descriptive statistics, frequency distribution, populations and sample, central tendency, variance data sampling, mean, median, mode, mean deviation, percentiles etc. Probability. Binomial, poison hyper- geometric, normal distributions, etc. Statistical inference intervals, tests hypothesis and significance. Regression and correlation.

**CHE 364: Chemical Process Design and Evaluation I (2 Units)**
General design considerations, Sources of design information: Equipment and flow-sheet symbols, Process design and development. Establishment of workable manufacturing processes, process conditions and facilities, Optimum design considerations. Process design of mass transfer equipment. Evaluation techniques, Development and presentation of design report.

**CHE 380: Polymer Process Engineering (2 Units)**
Introduction to the manufacture, processing, and applications of organic polymeric materials. The chemistry of polymer manufacture, the molecular structure of polymers, and the structure-property relationships for thermoplastic and thermosetting polymers are covered.

**CHE 382: Biochemical Engineering I (2 Units)**
Introduction to microbiology and biochemistry. Classification and growth characteristics of micro-organisms. Enzymes in engineering. Microbiolculture processes in manufacturing industries.

**CHE 392: Chemical Engineering Lab. II (2 Units)**
Laboratory experiments in transport phenomena. Separation processes and thermodynamics.

**400 LEVEL**

**CHE 414: Unit Operation IV (Separation Processes II) (2 Credits)**

Stage-wise and continuous contactors; Binary distillation; Leaching; Backed and plate columns; Drying of solids Multiple effects evaporators; Crystallization; Reverse Osmosis; Humidification, water cooling tower, solvent extraction, gas absorption; Ion-exchange operations; Condensation and boiling.

**CHE 415: Transport Phenomena III (2 Credits)**

Boundary layer theory; Navier strokes equation, universal velocity profile. Fick Law Gas diffusion; Maxwells diffusion law. Winkelman's two film theory; Highie's penetration theory; Dankert's random surface renewal; Mass transfer coefficients.

**CHE 423: Chemical Engineering Thermodynamics III (2 Credits)**

Carnot cycle; Thermodynamic cycle; The steam power plant, refrigeration and air conditioning cycles, liquefaction processes; Thermodynamic approach to fluid mechanics, thermodynamic of flow processes, conservation of mass and energy, the sonic velocity, metering and throttling processes, nozzles, compressors, ejectors.

**CHE 442: Chemical Process Dynamics and Control (2 Credits)**

Process dynamics, optimization, control, automation, dynamic analysis, models - mass-spring system, electrical R-C circuits, analogue computers; Response of first order systems, Laplace transformation, stability consideration, process control; Introduction to multi-variable control, the control valve.

**CHE 453: Chemical Process Design and Evaluation 1I (2 Credits)**

Sources of design data; Process charts and flow sheets, design selection, specification and design of heat transfer equipment; Mechanical design of process vessels and piping; Environmental consideration; Introduction to computer aided design and simulation. Case studies/mini projects.

**CHE 460: Chemical Process Economics (2 Credits)**

Types of investments, rate of return and other investment return techniques; Cash flow analysis, present worth methods, in choosing alternative investments; Discount cash flow analysis; Production cost; Breakeven analysis; Replacement problems - buy and hire considerations; Economic of scale, risks and uncertainty on investments including sensitivity analysis.

**CHE 470: Chemical Technology (2 Credits)**

The Nigerian Chemical Industry, utilization of raw materials, coal, petroleum, natural gas, air, water, agricultural products, wastes, manufacture of hydrogen and synthesis, gas, catalytic reforming of hydrocarbons with stream, ammonia, synthesis, nitrogenous fertilizers, ethylene.

**CHE 471: Environmental Pollution and Control (2 Credits)**

Principal pollutants and their sources; Municipal, industrial; Air pollution, technological sources of air pollution, principal pollutant emitted from combustion chambers; particulate, non-combustibles, unburnt particles, particles formed during combustion gasses, organic pollution. Combustion, noise, and dust.

**CHE 483: Chemical Engineering laboratory III (2 Credits)**

Further laboratory experiments in transport phenomena, kinetics and separation processes.

**CHE 490: Students Industrial Work Experience III (SIWES III) (2 Credits)**

On the job experience in industrial choice of practical working experience but not necessarily limited to the student's major (24 weeks from the end of the First Semester at 400 level to the beginning of the First Semester of the following sessions. Thus, the second semesters at 400 level are spent in industry).

**500 LEVEL COURSES**

**CHE 501: Loss Prevention in Process Industries (2Credits)**

Hazards in chemical process industries. Safety in plants. Causes of accidents in process plant. Prevention of accidents. Hazop technique. Maintenance of plant to minimize losses. Waste disposal and efficient treatment. Pollution control. Legal implications of various losses.

**CHE 539: Separation Processes III (2 Credits)**

Humidification and water-cooling; Solvent extraction; Extractive and azeotopic distillation; multi-component gas absorption; Distillation of multi-component mixtures; Novel distillation processes; Chromatography.

**CHE 554: Chemical Reaction Engineering III (2 Credits)**

Introduction to applied catalysis; Physical adsorption, chemisorption, adsorption isotherms, heat of adsorption selectivity, catalyst preparation, criteria and test of catalyst performance, characterization of the physiochemical properties of catalysts, texture and acidity of solid catalyst, deactivation of catalysts, kinetics and mechanisms of some industrial catalytic processes.

**CHE 502: Chemical Process Optimization (2 Credits)**

Theory of maxima and minima; Optimum searching techniques; analytical optimization procedures; Constrained and unconstrained problems; Theory of linear programming and its industrial application; unconstrained peak. seeking methods; Single and multi-variable search techniques; Constrained optimization techniques. Dynamic programming; Numerical optimization techniques; Discrete events.

**CHE 567: Chemical plant Design (2 Credits)**

A design problem involving the study of a process; Preparation of a flowsheet, preparation of heat and mass balance and detailed design of some plant items; Economics and safety considerations must be stressed.

**CHE 573: Engineering Management I (2 Credits)**

Critical study of the financial and Allied companies, Decree of 1990; Company law. Management and Finance, Memorandum and Articles of Association.

**CHE 574: Engineering Management II (2 Credits)**

Types and functions of management; Forms of business enterprises; Financial Management. Accounting principles, standard and marginal costing, budgeting techniques and budgetary control. Production management: types of production and factors of production for management; Production management techniques, inventory or stock control, network analysis, critical path, application of 'linear programming, simplex method for optimal conditions.

**CHE 581: Petroleum Refining and Processing (2 Credits)**

History and development of refining, -composition of petroleum and testing methods; Introduction to processing refinery and distillation process; Fractionation equipment, chemical treatment, heat exchangers, tube, still etc. Design of refining equipment; Types of refinery products, properties and application.

**CHE 582: Petrochemical Processing and Technology (2 Credits)**

Sources of petrochemicals, thermal cracking, catalytic cracking Reforming, natural gas and its utilization, refinery gases and their utilization. Carbon monoxide-based synthesis: manufacture of methyl alcohol, formaldehyde, hydrocarbons; Chlorination reactions and oxidation: Dichloroethane and isopropyl alcohol. Acetylene based synthesis; Manufacture of soap and detergents.

**CHE 583: Coal utilization and Processing Technology (2 Credits)**

Introduction to coal formation, physical and chemical properties of coal. Coal classification and characteristics; Rates of coal pyrolysis and gasification reaction, coal combustion. Sources of world energy; Selected topics in energy conversion; Relevance of energy conversion technology to Nigerian economy.

**CHE 584: Energy Conversion Technology (2 Credits)**

Energy classification and sources: Thermodynamic consideration; Mass-Energy dependence; Einstein equation, energy types and utilization; Alternative Energy sources; Energy conversion processes; Energy storage; Energy politics**.**

**CHE 597: Technical Communication (Seminar) (2 Credits)**

Oral communication: speaking skills with effective use of statistical and technical information.

Principles of effective communication in interpersonal and mass communication process. Written communication: principle of technical communication – in particular use in design and research reports.

**CHE 585: ELECTIVES (2 Credits)**

- Chemical Engineering in Biomedical systems
- Metallurgy and corrosion control.
- Chemical Process Synthesis and Simulation.
- Introduction to Nuclear Chemical Engineering.
- Glass and Ceramics Technology.
- Food Processing Engineering.
- Pharmaceutical Technology.
- Reservoir Engineering.
- Petroleum geology. Petroleum exploration. Crude oil production. Pollution control. Natural gas production.

**CHE 586: Biochemical Engineering II (2 Credits)**

Introductory Biotechnology. Definition and principles of biotechnology; areas of application in biotechnology. Methods of genetic modification of prokaryotic and eukaryotic organisms; to optimize biochemical characteristics and to stabilize cellular. Structure transformation transduction; conjugation and protoplasm fusion. Natural DNA recombination; advantages and method of induced phage virus bacterial plasmid or vector DNA mapping techniques; present and future prospect of utilization of created gene pools is selected topics of application areas e.g., Microbial enzyme technology, bioreactor design; practice of postharvest technology and agricultural waste recycling.

**CHE 588: Polymer Science and Technology/Engineering (2 Credits)**

Introduction to polymer and their characteristics. Source of monomers. Structure and physical properties of polymers: rheology, solubility and molecular weights. Plasticity and elasticity. The William Landel Ferry Equation, Polymerization reactions and manufacturing methods; Ziegler Natta catalysis. Processing and Technology of Polymers.

**CHE 599: Research Project (6 Credits)**

Individual research projects under the supervision of an academic staff. Projects should focus on National, State and Industrial needs and problems.

**Course Learning Outcomes for all levels**

**100Level Courses**

| No. | **Course Learning Outcome – GST 111 – Communication in English I** |
|---|---|
| **CLO1** | Apply effective communication and writing skills on simple engineering activities |
| **CLO2** | Apply essay writing skills (organization and logical presentation of idea, grammar and style) |
| **CLO3** | Demonstrate the application of comprehension, sentence construction, outlines and paragraphs |

| No. | **Course Learning Outcome – GST 121 – Use of Library, Study Skills and ICT** |
|---|---|
| **CLO1** | Discuss in brief the history of libraries, library and education |
| **CLO2** | Acquaint with university libraries and other types of libraries, study skills (reference services) |
| **CLO3** | Identify the types of library materials, using library resource including e-learning, e-materials, etc., |
| **CLO4** | Understanding library catalogues (card, OPAC, etc.) and classification, copyright and its implications |
| **CLO5** | Apply database resources, bibliographic citations and referencing |
| **CLO6** | Introduction to development of modern ICT, Hardware technology, Software technology, input devices, storage devices, output devices, communication and internet services, word processing skills (e.g., typing etc.) |

| No. | **Course Learning Outcome – GST 112 – Communication in English II** |
|---|---|
| **CLO1** | Introduction to logical presentation of papers, phonetics, instruction on lexis |
| **CLO2** | Apply the art of public speaking and oral communication, figures of speech and précis |
| **CLO3** | Using report writing |

| No. | **Course Learning Outcome – GST 118 – Peace and Conflict Resolution** |
|---|---|
| **CLO1** | Introduction to basic concepts in peace studies and conflict resolution, peace as vehicle of unity and development |
| **CLO2** | Introduction to conflict issues, types of conflict e.g., Ethnic/Religious/political/economic conflicts, the root causes of conflict and violence in Africa |
| **CLO3** | Identify and use the indigene/settler phenomenon, peace-building, management of conflict and security |
| **CLO4** | Application of elements of peace studies and conflict resolution, developing a culture of peace, peace mediation and peace-keeping |
| **CLO5** | Demonstrate the application of Alternative Dispute Resolution (ADR), dialogue/arbitration in conflict resolution |
| **CLO6** | Study the role of international organizations in conflict resolution e.g., ECOWAS, Africa Union, United Nations, etc., |

| No. | **Course Learning Outcome – MEC 122 – Basic Engineering Drawing** |
|---|---|
| **CLO1** | Introduction to Engineering Drawing as a means of communication |
| **CLO2** | Apply the Engineering drawing format, use of drawing instruments |
| **CLO3** | Identify the types of lines and their uses in Engineering drawing |
| **CLO4** | Demonstrate the application of circles and tangent, circles to satisfy conditions involving other circles, lines and points |
| **CLO5** | Identify and use the conic sections, and various methods of their construction |
| **CLO6** | Understand and apply the theory of projection, perspective (briefly), parallel projections (oblique general, cavalier, cabinet) |

| No. | **Course Learning Outcome – ICH 111 – General Chemistry I** |
|---|---|
| **CLO1** | Describe the terms: atoms, molecules and chemical reactions |

| | |
|---|---|
| **CLO2** | Apply the modern electronics theory of atoms to solve problems |
| **CLO3** | Identify and use the electronic configuration, periodicity and building up of the periodic table |
| **CLO4** | application of hybridization and shapes of simple molecules, valence forces and structure of solid |
| **CLO5** | Apply the chemical equations and stoichiometry, chemical bonding and intermolecular forces, kinetic theory of matter |
| **CLO6** | Demonstrate the application of Elementary thermo chemistry, rates of reaction, equilibrium and thermodynamics |
| **CLO7** | Study the properties of gases, redox reactions and introduction to electrochemistry, radioactivity |

| No. | **Course Learning Outcome – ICH 112 – General Chemistry II** |
|---|---|
| **CLO1** | History survey of the development and importance of organic chemistry |
| **CLO2** | Apply the electronic theory in organic chemistry, isolation and purification of organic compound |
| **CLO3** | Study the determination of structures of organic compounds including qualitative and quantitative analysis inorganic chemistry |
| **CLO4** | Describe the nomenclature and functional group classes of organic compounds |
| **CLO5** | Application to introductory reaction mechanism and kinetics, stereo chemistry |
| **CLO6** | Apply the chemistry of alkanes, alkenes, alkynes, alcohols, ethers, amines, alkylamines, nitriles, aldehydes, ketones, carboxylic acids and derivative |

| No. | **Course Learning Outcome – ICH 197 – General Practical Chemistry I** |
|---|---|
| **CLO1** | Apply the laboratory experiments designed to reflect the topics taught in ICH 111 and ICH112 such as qualitative and quantitative chemical analysis, acid-base titrations |
| **CLO2** | Application of gravimetric analysis, calculation, data analysis and presentation |
| **CLO3** | Identify and use functional group analysis |

| No. | **Course Learning Outcome – ICH 198 – General Practical Chemistry II** |
|---|---|
| **CLO1** | Apply the continuation of laboratory experiments designed to reflect the topics taught in ICH 111 and ICH112, some of the experiments will have been carried out in ICH 117 |
| **CLO2** | Application of gravimetric analysis, calculation, data analysis and presentation |

| No. | **Course Learning Outcome – MAT 111 – Elementary Mathematics I (Algebra and Trigonometry)** |
|---|---|
| **CLO1** | Introduction to elementary set theory, subsets, union, intersection, complements, Venn diagrams |
| **CLO2** | Apply real numbers, integers, rational and irrational numbers |
| **CLO3** | Applying mathematical induction, real sequences and series |
| **CLO4** | Introduction to theory of quadratic equations, binomial theorem, complex numbers, algebra of complex numbers the Argand diagram |
| **CLO5** | Identify and enlist Crystallization process, Reverse Osmosis, Humidification |
| **CLO6** | Demonstrate the application of De-Moire's theorem, in throats of unity, circular measures, trigonometric functions of angles of any magnitude, addition and factor formulae |

| No. | **Course Learning Outcome – MAT 112 – Elementary Mathematics II (Calculus)** |
|---|---|
| **CLO1** | Introduction and application of Trapezoidal and Simpon's rule |
| **CLO2** | Apply functions of a real variable, graphs, limits and idea of continuity |
| **CLO3** | Applying the derivative as limit of rate of change |
| **CLO4** | Identify and use techniques of differentiation, maxima and minima to solve Engineering problems |
| **CLO5** | Demonstrate the application of extreme curve sketching, integration, definite integrals, reduction formulae, application to areas, volumes (including approximate integration) |

| No. | **Course Learning Outcome – PHY 111 – General Physical I (Mechanics, Thermal Physics and Waves)** |
|---|---|
| **CLO1** | Introduction to the concept of space, time, units and dimension, kinematics, fundamental law of mechanics, statics and dynamics, work and energy, conservation laws |
| **CLO2** | Apply moments, energy of rotation, simple harmonic motion, motion of simple system, elasticity |
| **CLO3** | Application of Hooke's law, Young's shear and bulk moduli, Hydrostatics, pressure buoyance to solve problems |
| **CLO4** | Introduction to Archimedes' principles, surface tension, adhesion cohesion, capillarity, drops and Bubbles |
| **CLO5** | Use of temperature, heat, gas law, laws of thermodynamics, kinetic theory of gases, sound |
| **CLO6** | Demonstrate the application of the unified spectra analysis of waves, superposition of waves, propagation of sounding gases, solid and liquids and their properties |
| **CLO7** | Use the types of properties of waves as applied to sound and light energies |

| No. | **Course Learning Outcome – PHY 112 – General Physics II (Electricity, Magnetism and Modern Physics)** |
|---|---|
| **CLO1** | Introduction to Electrostatics, conductors and currents, dielectrics, magnetic fields and electro-magnetic induction |
| **CLO2** | Application of Maxwell's equations, electromagnetic oscillations and waves |
| **CLO3** | Applying Coulomb's law, methods of charging and ohm's law to solve problems |
| **CLO4** | Demonstrate the application of analysis of DC circuits, AC voltages applied to inductors, capacitors and resistance |

| No. | **Course Learning Outcome – PHY 197: General Practical Physics I** |
|---|---|
| **CLO1** | Introductory course emphasizes quantitative measurements, the treatment of measure errors and graphical analysis |

| | |
|---|---|
| **CLO2** | Carrying out experiments using variety of experimental techniques |
| **CLO3** | Study of the meters, the oscilloscope, mechanical systems, electrical and mechanical resonant systems, light, heat, viscosity etc., |
| **CLO4** | This course is covered in PHY111 and PHY112, however, emphasis should be place on the basic physical techniques for observation, measurements, data collection, analysis and deduction |

| No. | **Course Learning Outcome – PHY 198 – General Practical Physics II** |
|---|---|
| **CLO1** | Continuation of the experiments designed for PHY111 and PHY112 some of which have been covered under PHY197 |

| No. | **Course Learning Outcome – CEE 121 – Computer Programming** |
|---|---|
| **CLO1** | Introduction to computers and computing problems solving on computer algorithms, design using flowchart and pseudo-code |
| **CLO2** | Introduction to high level programming languages, Basic and FORTRAN syntax, flow of control, input/output constructs, data types |
| **CLO3** | Identify and use programming in FORTRAN |
| **CLO4** | Demonstrate an extensive exercises in using flowchart and pseudo-code to solve Engineering problems |

| No. | **Course Learning Outcome – MME 112 – Engineering Materials** |
|---|---|
| **CLO1** | Introduction to electronics configuration, atomic structures, inter-atomic bonding mechanisms, crystal and microstructure |
| **CLO2** | Apply the relationship between structure and properties of metals, alloys, ceremics and plastics |
| **CLO3** | Apply the principles of behaviour of materials in common environments |
| **CLO4** | Study the fabrication processes and its applications |

**200Level Courses**

| No. | **Course Learning Outcome – ENS 222 – Introduction to Entrepreneurship** |
|---|---|
| **CLO1** | Introductory entrepreneurial skills. |
| **CLO2** | Analyze the relevant concepts: Enterprise, entrepreneur, entrepreneurship, Business, Innovation, Creativity, Enterprising and entrepreneurial attitude and behavior. |
| **CLO3** | Describe the rationale for entrepreneurship, creativity and innovation for entrepreneurs and evaluate leadership and entrepreneurial skills for coping with challenges. |
| **CLO4** | Determining capital requirement and raising capital, financial planning and management, Legal issue, insurance and environmental consideration. |
| **CLO5** | Outline and explain extensively the unit operations and time management. |
| **CLO6** | Identify some overcoming job creation challenges which may arise, and evaluate opportunities for entrepreneurship, |
| **CLO7** | Identify the features of creativity and innovation for self-employment in Nigeria. |
| **CLO8** | Describe the forms of businesses, staffing, marketing and the new enterprise, feasibility studies and starting a new business. |
| **CLO9** | Explanation, done on the other side of the spectrum, are employability, skills-interview techniques, oral presentation skills, etc, |

| No. | **Course Learning Outcome – EEE 221 – Applied Electricity I** |
|---|---|
| **CLO1** | Identify the general application of electricity |
| **CLO2** | Analyze the fundamental concepts-electric field, charges and magnetic fields |
| **CLO3** | Explain the concept of Current B-H curves Kirchhoff's laws, superposition. |
| **CLO4** | Apply the concept of venin, Norton theorems, Reciprocity, RL, RC RLC circuit |
| **CLO5** | Demonstrate the concept and application of DC, AC bridges, Resistance, capacitance, inductance measurement, transducers, single phase circuits, complex J-notion, AC circuits, impedance, admittance, subscription. |

| No. | **Course Learning Outcome – EEE 222 – Applied Electricity II** |
|---|---|
| **CLO1** | Identify the fundamental concept of applied electricity |
| **CLO2** | Demonstrate the application of Basic machine – DC, synchronous alternators, transformers and equivalent circuits. |
| **CLO3** | Explain three phase balanced circuits, PN junction Diode, transistors, thyristors FRTs, Zener and Rectifiers. |
| **CLO4** | Apply the concept of Basic control systems, open/close loop systems. |
| **CLO5** | Identify the concept of Communications fundamentals, introduction of TV, Radio Telephone systems. |

| No. | **Course Learning Outcome – MEC 223 – Engineering Drawing I** |
|---|---|
| **CLO1** | Demonstrate general Revision of multi-view representation. |
| **CLO2** | Show harder examples on two and three view representation ($1^{st}$and $3^{rd}$ Angles). |
| **CLO3** | Show and engage in harder examples on isometric drawing to include simple pictorial assembly drawing in isometric. |
| **CLO4** | Demonstrate harder examples on oblique drawing (Cavalier, Cabinet and Angles other than 45 degrees). |
| **CLO5** | Explain the concept of Dimensioning, Sections and conventions Auxiliary views, Representation and specification of threads. |
| **CLO6** | Analyze and draw Bolted joints, Keys and cottered joints. Exposing Conventional representations |

| No. | **Course Learning Outcome – MEC 224 – Engineering Drawing II** |
|---|---|
| **CLO1** | Further works on projections; |
| **CLO2** | Demonstrate projection of points, lines, planes and solids. |
| **CLO3** | Explain and identify intersections of solids, Cams, Interpretation of solids and |

| | |
|---|---|
| | Development of surfaces. |
| **CLO4** | Describe the details in drawing belts, chains, gears, bearing and lubrication arrangements. |
| **CLO5** | Explain and demonstrate Couplings brake, flexible shafts, universal joints, etc. |
| **CLO6** | Describe assembly drawings and extensive revision |

| No. | **Course Learning Outcome – FEG 294 – Student Workshop Experience** |
|---|---|
| **CLO1** | Guide the student in the Introduction to practical and skills in general engineering and powered tools wood through instruction in operation of hand |
| **CLO2** | Explain and illustrate metal cutting and fabrication. |
| **CLO3** | Analyze the performances and experience in safe usage of tools and machines for selected tasks |

| No. | **Course Learning Outcome – CHE 225 – Fundamental of Fluid Mechanics** |
|---|---|
| **CLO1** | Explain the general concept of fluid and further identifying the properties of fluids, |
| **CLO2** | Demonstrate friction effects and losses in laminar and turbulent flows ducts and pipes. |
| **CLO3** | Analyze the concept of Dimensional analysis and dynamic similitude, |
| **CLO4** | Explain and illustrate fluids statics conservation laws |
| **CLO5** | Analyze the phenomena regarding principles of construction and operation of selected hydraulic machinery. |
| **CLO6** | Identify and use hydro power systems. |

| No. | **Course Learning Outcome – CEE 221 – Introduction to Modeling and Simulation** |
|---|---|
| **CLO1** | Explain the Introduction to computers and computing problems solving on |

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|---|---|
| | computer algorithms, design using flowchart and pseudo-code |
| **CLO2** | Describe the generation knowledge to the Introduction to high level programming languages. |
| **CLO3** | Illustrate the phenomena of the following programming languages like Basic and FORTRAN syntax |
| **CLO4** | Show and explain the flow of control, input/output constructs and evaluates some data types |
| **CLO5** | Extensive exercises in solving engineering problems using flowchart and pseudo-code |
| **CLO6** | Engaging in thorough practical with regard to programming, (Programming in FORTRAN). |

| No. | **Course Learning Outcome – CHE 226 – Fundamental of Thermodynamics** |
|---|---|
| **CLO1** | Understand and Analyze the basic concepts of the quantitative relations of zeroth, first, second and third laws of thermodynamics. |
| **CLO2** | Identify and evaluate the behavior of pure substances and perfect gases. |
| **CLO3** | Explain the phenomena of ideal gas cycles |
| **CLO4** | Illustrate and use the above theories in solving engineering problems |

| No. | **Course Learning Outcome – CVE 227 – Applied Mechanics** |
|---|---|
| **CLO1** | Explain and illustrate the concept of Forces, moments and couples. |
| **CLO2** | Describe the phenomena of Newton's laws of motion |
| **CLO3** | Identify the features of kinetic energy and momentum analysis |
| **CLO4** | Explain kinematic of particles and rigid bodies in plane motion. |
| **CLO5** | Solving general engineering problems with respect to the above topics |

| No. | **Course Learning Outcome – CVE 228 – Strength of Materials** |
|---|---|
| **CLO1** | Recognise a structural system that is stable and in equilibrium |
| **CLO2** | Determine the stress-strain relation for single and composite members based on Hooke's law |
| **CLO3** | Estimate the stresses and strains in single and composite members due to temperature changes |
| **CLO4** | Evaluate the distribution of shear forces and bending moments in beams with distributed and concentrated loads |
| **CLO5** | Determine bending stresses and their use in identifying slopes and deflections in beams |
| **CLO6** | Use Mohr's circle to evaluate the normal and shear stresses in a multi-dimensional stress system and transformation of these stresses into strains |
| **CLO7** | Evaluate the stresses and strains due to torsion on circular members |
| **CLO8** | Determine the buckling loads of columns under various fixity conditions at the ends. |

| No. | **Course Learning Outcome – FEG 221 – Engineer in Society** |
|---|---|
| **CLO1** | differentiate between science, engineering and technology, and relate them to innovation |
| **CLO2** | distinguish between the different cadres of engineering – engineers, technologists, technicians and craftsmen and their respective roles and competencies |
| **CLO3** | identify and distinguish between the relevant professional bodies in engineering |
| **CLO4** | categorise the goals of global development or sustainable development goals (SDGs) |
| **CLO5** | identify and evaluate safety and risk in engineering practice |

| No. | **Course Learning Outcome – FEG 227 – Engineering Mathematics 1** |
|---|---|
| **CLO1** | Analyze the concepts of Limits and continuity |
| **CLO2** | Fully describe and illustrate the general concept of differentiation |
| **CLO3** | Explain the introduction to linear first order differential equations, partial and total derivatives |
| **CLO4** | Illustrate the application of composite functions, matrices and determinants, |
| **CLO5** | Solve more solutions involving vector algebra, vector calculus and directional derivatives. |

| No. | **Course Learning Outcome – FEG 228 – Engineering Mathematics II** |
|---|---|
| **CLO1** | Demonstrate and use second order differential equationsin solving engineering problems |
| **CLO2** | Identify and use line integral multiple integral and their applications |
| **CLO3** | Explain and apply differentiation of integral in solving engineering problems |
| **CLO4** | Analyze different phenomena associated with analytical functions of complex variables. |
| **CLO5** | Demonstrate the concept of Transformation and mapping and evaluate Special functions |

| No. | **Course Learning Outcome – FEG 293 – General Engineering Laboratory Course** |
|---|---|
| **CLO1** | Demonstrate and analyze laboratory investigation and report submission for selected experiments and projects in Thermodynamics, Applied Mechanics, Applied Electricity and Fundamental of fluid mechanics. |

| No. | **Course Learning Outcome – FEG 221 – Student Industrial Work** |
|---|---|

| | **Experience** |
|---|---|
| **CLO1** | Evaluate the experience gathered during IT which happens to take place from a chosen practical experience (this last for 8 weeks during the long vacation following 200 level) |
| **CLO2** | Analyze the performance of the students. |

**300Level Courses**

| No. | **Course Learning Outcome – ENS 311 – Engineering Practicum** |
|---|---|
| **CLO1** | Identify the profiles in business ventures for all business sectors involving production, training and sales to prepare and boost the engineering students in particular. |
| **CLO2** | Demonstrate the acts involve in the business initiatives in the production of house hold products like production of Soap/Detergent, Toothbrush and Toothpaste making, photography, Brick making, metal fabrication, Rope making, Brewing, Glassware production/ceramic production, paper production to equip the students in entrepreneurship. |
| **CLO3** | Further describe the production of agricultural and environmental products like water treatment/ conditioning/ packaging; food processing/preservation/packaging, vegetable oil extraction; farming; fisheries/aquaculture; plastic making; refrigeration/Air-conditioning; carving, weaving, carpentry, interior decoration, animal husbandry. |
| **CLO4** | Identify and analyze case study methodology applied to the development and administration of cases that bring out key issues of business environment, start up, pains and gains of growth of businesses, etc. with particular reference to Nigerian businesses. |
| **CLO5** | Outline the experience sharing by business actors in the economy with students during case presentations as means of evaluating the student performance. |
| **CLO6** | Clearing observing the impacts of production in the business venture. |

| No. | **Course Learning Outcome – FEG 321 – Engineering Mathematics III** |
|---|---|
| **CLO1** | Identify and solve problems regarding Linear Algebra, Elements of matrices. Determinants, inverses of matrices theory of linear equations, eigen values and eigen vectors. |
| **CLO2** | Identify and use the concept of analytical geometry, coordinate transformation, solid geometry, polar, cylindrical and spherical coordinates, elements of functions of several variables, surface variables. |
| **CLO3** | Demonstrate the application of ordinary integrals, evaluation of double integrals, triple integrals, line integrals and surface integrals. |
| **CLO4** | Identify and apply the concept of vectors including derivation and integrals of vectors, The gradient of scalar quantities, flux of vectors, the curl of vectors, field, Gauss, Greens and Stroke's theorems. |
| **CLO5** | Demonstrate the application of the following functions; Singular values functions, Multi valued functions and analytical functions. |
| **CLO6** | Identify the concept of cauchy Riemann's singularities and Zeroes, Contour Integration including the use of cauchy's integral theorems, bilinear Transformation. |

| No. | **Course Learning Outcome – CHE 301 – Process Instrumentation** |
|---|---|
| **CLO1** | Identify and apply the concept of internal and physical properties |
| **CLO2** | Categorize measuring instruments for industrial applications and illustrate instrumentation for temperature, pressure, flow, level, composition and pH. |
| **CLO3** | Chemical composition analyzers. |
| **CLO4** | Identify the general concept of measurements and applications |
| **CLO5** | Illustrate the phenomena of Gas chromatograph and Mass Spectrometer also including its application |
| **CLO6** | Analyze the various sampling systems. |

| No. | **Course Learning Outcome – CHE 331 – Transfer Phenomena I (Heat Transfer)** |
|---|---|
| **CLO1** | Identify and distinguish various modes of heat transfer, examine the mechanisms involved and the associated governing laws. Evaluate mechanism of radiative heat transfer and analyze Heat exchange between radiating surfaces. |
| **CLO2** | Choose appropriate governing equations and analyze the different modes of heat transfer in different geometries and systems under steady and transient processes. Compare the different heat transfer processes based on the concept of analogy. |
| **CLO3** | Identify and explain the following concept; Unsteady state conduction. Free and forced convective heat transfer, Compressible flow, Normal shockwaves and Non-Newtonian fluids. |
| **CLO4** | Perform basic calculations to determine relevant design parameters for common heat exchangers and determination of heat transfer coefficients. |
| **CLO5** | Apply the concept of diffusion involving vapors, liquids and solids. |
| **CLO6** | Analyze the heat transfer associated with boiling and condensation and application to design of heat exchanges. |

| No. | **Course Learning Outcome – CHE 333 – Transfer Phenomena II (Mass Transfer)** |
|---|---|
| **CLO1** | Identify the concept of Boundary layer theory and turbulence. |
| **CLO2** | Identify and use the concept of Navier-Stokes equations |
| **CLO3** | Identify and apply the concept of Universal Velocity profile. |
| **CLO4** | Illustrate the phenomenon and application of Condensation and boiling. |
| **CLO5** | Explain and demonstrate the theories of mass transfer including mass transfer with chemical reaction |

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| **CLO6** | Explain the phenomena of molecular diffusion, eddy diffusion and interphase mass transfer |

| No. | **Course Learning Outcome – CHE 335 – Particle Technology** |
|---|---|
| **CLO1** | Evaluate the particle size distribution, mean particle diameter, specific surface area and number of particles per unit mass using techniques such as sieve analysis, pipette analysis and beaker decantation |
| **CLO2** | Identify and analyze the properties of particles, evaluating the motion of particles in fluid and flow through packed beds. Explain the concept of stokes's and Newton's laws |
| **CLO3** | Demonstrate the application of screening and evaluate the classification and grinding with respect to particles. |
| **CLO4** | Select suitable size reduction equipment and estimate the energy requirements for a specified reduction in size for a given material. |
| **CLO5** | Describe separation techniques for particulates using different separation techniques |
| **CLO6** | Apply the concept of Fluidization, Sedimentation and flocculation, Filtration, Screening, Classification, grinding and applications. |

| No. | **Course Learning Outcome – CHE 341 – Chemical Engineering Thermodynamics I** |
|---|---|
| **CLO1** | Apply the concepts of Cycles, Carnot; thermodynamic Turbines Seamand Gas, Refrigeration; and evaluate general P-V-T Relations. |
| **CLO2** | Describe the P-V-T behaviour of pure substances, Equation of state for gasses, the principle of corresponding state, Compressibility relations, reduced pressure, reduce volume, temperature, and pseudo critical constants. |
| **CLO3** | Identify and use P-V-T approximations for gaseous mixture ideal gas mixtures. Dalton's law of additive pressure; Amagat's law of additive volumes; Pseudo critical point method; Kay's rule, Gilliland's method; Behaviour of liquids.. |

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| **CLO4** | Describe Heat Effects, Heat capacities as a function of temperature, specific heats of liquids and solids; Heat effects accompanying phase change Clausius-Clapeyron equation, standard heats of reaction formation and combustion effect of temperature on heat reaction |
| **CLO5** | Explain the Heat of mixing and solution, Enthalpy concentration diagrams for $H_2SO_4$, $H_20$, etc., partial enthalpies, single and multiple effect evaporators with regards to heat effects. |
| **CLO6** | Analyze Thermodynamics of Flow Processes involving fundamental equations, continuity equation, equation of motion, energy equation, Bernoulli's equation, Flow in pipes, laminar and turbulent flows, Reynolds number, Fanning equation and friction factor. |
| **CLO7** | Demonstrate the application of Flow meter, Nozzles, Compressors single stage and multistage, and evaluating the effect of Clearance. |

| No. | **Course Learning Outcome – CHE 351 – Chemical Reaction Engineering** |
|---|---|
| **CLO1** | Analyze the mechanism of chemical reactions including measurement and analysis of weathering reaction. |
| **CLO2** | Determine the chemical kinetic parameters involving heterogeneous and catalytic reaction |
| **CLO3** | Identify and use ideal reactors for single, complex reactions and chain reactions. |
| **CLO4** | Develop skills to choose the right reactor for multiple reactions. |
| **CLO5** | indentify the phenomena of photochemistry and adsorption of gases on solids |
| **CLO6** | Analyze and illustrate the application of gas chromatography |

| No. | **Course Learning Outcome – CHE 361 – Introduction to Material & Energy Balance /Chemical process principles.** |
|---|---|
| **CLO1** | Understand the concept of Units and dimensions, The mole unit, Conventions in the method of analysis and measurement, Temperature, |

| | |
|---|---|
| | Pressure, Physical and chemical properties and measurement. Techniques of solving problem |
| **CLO2** | Demonstrate the application of chemical equation stoichiometry, material balances, Program of analysis of material balances, Program of analysis of material balances problem, problems with direct solutions, Material balances using algebraic techniques control surface and stage balances for open and closed system |
| **CLO3** | Describe the problems involving components (elements), Recycle, Bypass, Purge; Effect of recycle and purge on mass and energy balances. |
| **CLO4** | Apply the phenomena of Gases, vapours, liquid and solids and explain the following; Ideal gas law, Real gas relationships, Vapour pressure, Saturation, Partial saturation and humidity. |
| **CLO5** | Identify and use Material balanced involving condensation and vaporization phase phenomena, Energy balances, Concepts and Units, Heat capacity, Calculation of enthalpy changes without change phase, Enthalpy for phase transition in chemical process computation |
| **CLO6** | Demonstrate the concept of General Energy balance involving mechanical energy balance in Reversible processes |
| **CLO7** | Explain the concept of Heat of reaction, Heat of solution and mixing combine material and energy balances; Application of fundamental concept of mass and energy balances and mass transfer to unit operation in distillation an finally the Simultaneous use of material and energy balances for the steady state. |
| **CLO8** | Describe Complex problems; Lever rule Geometrical construction for mass and evaluate Energy balances for adiabatic and non-adiabatic process and also for Unsteady state material and energy balances. |

| No. | **Course Learning Outcome – CHE 391 – Chemical Engineering Laboratory I** |
|---|---|
| **CLO1** | Explain the concept of experiment and illustrate the steps involve in carrying of any experiment. |

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| **CLO2** | Identify and apply procedures in writing experimental reports |
| **CLO3** | Demonstrate laboratory experiments in transport phenomena |
| **CLO4** | Illustrate laboratory experiments in Kinetics and separation process |

| No. | **Course Learning Outcome – FEG 322 – Engineering Mathematics IV** |
|---|---|
| **CLO1** | Use Mathematical tools in solving complex Engineering mathematical problems |
| **CLO2** | Employ simple approach in Solving Numerical integration, Laplace transformation, various level of differential equations. |
| **CLO3** | Explain and Calculate Sturm-Liouville Boundary value problems and Fouries Series Partial Differential Equation. |
| **CLO4** | discuss and Solve Linear, Homogenous and Partial differential equations of $9^{th}$ order with Constant Coefficients |
| **CLO5** | Explain and use different techniques in solving Integral Transforms |

| No. | **Course Learning Outcome – FEG 390 – Students Industrial Work Experience II (SIWES II)** |
|---|---|
| **CLO1** | Evaluate the experience gathered during IT which happens to take place from a chosen practical experience (this last for 12 weeks during the long vacation following 300 level) |
| **CLO2** | Analyze the performance of the students. |

| No. | **Course Learning Outcome – CHE 332 – Separation Process I** |
|---|---|
| **CLO1** | Identify and use of separation process in solving several engineering problems |
| **CLO2** | Demonstrate the application of Separation process generally in all chemical process and evaluating the process and type of equipment |

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| | (Stage-wise and continuous contact equipment) |
| **CLO3** | Identify the concept of adsorption Isothermal gas absorption processes |
| **CLO4** | Apply the concept of Binary distillation, mechanisms involve and evaluating the analytical and graphical approaches. |
| **CLO5** | Illustrate the relevance of both hydrodynamics of packed and plate columns in distillation and adsorption processes |
| **CLO6** | Explain the concept of Leaching |

| No. | **Course Learning Outcome – CHE 362 – Chemical Reaction Engineering II** |
|---|---|
| **CLO1** | Identify different types of reactions |
| **CLO2** | Apply the concept of reaction in determining reaction rate and variables determining reaction rate |
| **CLO3** | Explain the phenomena in Arrhenius equations and evaluate Arrhenius rate expressions from postulated mechanisms |
| **CLO4** | Interpretation of batch reaction data, Integral and differential methods of analysis, Reversible, parallel, series, autocatalytic reactions in chemical reaction principles |
| **CLO5** | Demonstrate the optimization of output and yield from reactor and evaluate the comparison of various performances (PRR, CSIR, BR) |
| **CLO6** | Explain and analyze photochemistry |

| No. | **Course Learning Outcome – CHE 362 – Process Simulation And Statistics For Physical Science And Engineering** |
|---|---|
| **CLO1** | Understand the general concept of process simulation and focusing more on the use and application of HYSYS software or any other process simulation software |
| **CLO2** | Evaluate the performances of students in using the software in |

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|---|---|
| | simulation processes |
| **CLO3** | Identify and explain the concept of probability, Binomial poison hyper-geometric and normal distribution for providing solutions to engineering problems |
| **CLO4** | Analyze and point out the application of statistical inference intervals tests hypothesis and significance. |
| **CLO5** | Analyze the concept of Regression and correlation in solving some Engineering problems |
| **CLO6** | Comparing the general statistical approach in engineering problems. |

| No. | **Course Learning Outcome – CHE 364 – Chemical Process Design And Evaluation I** |
|---|---|
| **CLO1** | Identify and analyze general design considerations and optimum design considerations |
| **CLO2** | Identify and describe different Sources of design information |
| **CLO3** | Identify and use the establishment of workable manufacturing processes, process conditions and facilities |
| **CLO4** | Apply the concept of Process design of mass transfer equipment |
| **CLO5** | Demonstrate the application of Evaluation techniques in design principles |
| **CLO6** | Describe patterns in development and presentation of design report. |

| No. | **Course Learning Outcome – CHE 380 – Polymer Process Engineering** |
|---|---|
| **CLO1** | Analyze and explain the concept of process including introduction, processing, and applications of organic polymeric materials. |
| **CLO2** | Explain the phenomena behind the chemistry of polymer manufacture |

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| **CLO3** | Explain the concept of molecular structure of polymers |
| **CLO4** | Identify the several defects of polymers, causes and preventions to proffer engineering solution |
| **CLO5** | Identify the structure-property relationships for thermoplastic and thermosetting polymers are covered |
| **CLO6** | General application of the polymer products, their fabrication using some additives are further stress. |

| No. | **Course Learning Outcome – CHE 382 – Biochemical Engineering** |
|---|---|
| **CLO1** | Explain the concept regarding the Introduction to microbiology and biochemistry to further expose the foundational level to the engineering students. |
| **CLO2** | Analyze and demonstrate the classification and growth characteristics of micro-organisms in biochemical process. |
| **CLO3** | Explain the concept regarding enzymes in engineering. |
| **CLO4** | Apply the concept of Microbiolculture processes in manufacturing industries. |
| **CLO5** | Design several reactors used as bioreactors using material balance principles. |
| **CLO6** | General utilize the understanding of microbiology and biochemistry in engineering processes |

| No. | **Course Learning Outcome – CHE 392 – Chemical Engineering Laboratory II** |
|---|---|
| **CLO1** | Further bring back and explain the concept of experiment and illustrate the steps involve in carrying of any experiment. |
| **CLO2** | Identify and apply procedures in writing experimental reports |
| **CLO3** | Demonstrate laboratory experiments in transport phenomena |

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| **CLO4** | Illustrate laboratory experiments in separation process and thermodynamics |

400Level

| No. | **Course Learning Outcome –CHE 414 – Separation Process II** |
|---|---|
| **CLO1** | Apply the concept of Stage-wise and Continuous contactors to solve engineering problems |
| **CLO2** | Apply the concept of Binary distillation to solve Engineering problems, understanding the process involved in Leaching, Packed and plate columns |
| **CLO3** | Identify and use the Drying of solids |
| **CLO4** | Describe the process of Multiple-effect evaporators |
| **CLO5** | Identify and enlist Crystallization process, Reverse Osmosis, Humidification |
| **CLO6** | Demonstrate the application of solvent extraction, Condensation process, Gas adsorption theorems |

| No. | **Course Learning Outcome – CHE 415 – Transport Phenomena III** |
|---|---|
| **CLO1** | Demonstrate the application of Boundary layer theory, Navier stokes equation to solve Engineering<br>Problems |
| **CLO2** | Identify and use the Fick's law Gas diffusion, Maxwell's diffusion law to solve Engineering problems |
| **CLO3** | Understand the concept of Winkelman's two film theory |
| **CLO4** | Apply the Highie's penetration theory to solve Engineering problems |
| **CLO5** | Identify and use the Dankert's random surface renewal |
| **CLO6** | Demonstrate the application of Mass transfer coefficient process to solve Engineering problems |

| No. | **Course Learning Outcome – CHE 423 – Chemical Engr. Thermodynamics III** |
|---|---|
| **CLO1** | Understand and apply the Carnot cycle, thermodynamics cycle process to solve Engineering problems |
| **CLO2** | Apply the concept of Refrigeration and air conditioning cycle processes to solve Engineering problems |
| **CLO3** | Identify and use the Liquefaction processes, Nozzles, Compressors, ejectors |
| **CLO4** | Apply the Thermodynamics approach to solve fluid mechanics problems |
| **CLO5** | Identify and use the Thermodynamics of flow processes to solve Engineering problems |
| **CLO6** | Demonstrate the application of the Sonic velocity, Metering and Throttling processes |
| **CLO7** | Understanding the concept of conservation of Mass and Energy in solving Engineering problems |

| No. | **Course Learning Outcome – CHE 442 – Chemical Process Dynamics and Control** |
|---|---|
| **CLO1** | Describe the concept of process dynamics, optimization and control |
| **CLO2** | Apply the concept of Automation, Dynamic analysis and Models-mass-spring system |
| **CLO3** | Identify and use the Electrical R-C circuits and analogue computers |
| **CLO4** | Apply the Laplace transformation process to solve fluid mechanics problems |
| **CLO5** | Identify and use the Response of first order systems, stability consideration and process control to solve problem |
| **CLO6** | Introduction to Multi-variable control and control valve |

| No. | **Course Learning Outcome – CHE 453 – Chemical Process Design and Evaluation II** |
|---|---|
| **CLO1** | Describe the concept of sourcing of design data, process charts and flow sheets |

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| **CLO2** | Apply design selection, specification tools in the design of heat transfer equipment like double pipe heat exchanger, shell and tube heat exchanger and condenser |
| **CLO3** | Identify and use the Mechanical design of process vessels and piping tool to solve Engineering problems |
| **CLO4** | Apply the environmental consideration in solving design problems |
| **CLO5** | Introduction and application of computer aided design and simulation using different softwares |
| **CLO6** | Construct detailed proportionate drawings of double pipe heat exchanger, shell and tube heat exchanger and condenser. |

| No. | **Course Learning Outcome – CHE 460 – Chemical Process Economics** |
|---|---|
| **CLO1** | Understanding and applying the Types of investments, analysing the rate of return |
| **CLO2** | Apply the concept of other investment return techniques |
| **CLO3** | Identify and use the Cash flow analysis, present worth methods in choosing alternative investments |
| **CLO4** | Apply the Discount cash flow analysis, Breakeven analysis tools and evaluate the Production cost |
| **CLO5** | Identify and use the Replacement problems – buy and hire considerations to solve problems |
| **CLO6** | Evaluating the Economic of scale, risks and uncertainty on investments including sensitivity analysis |

| No. | **Course Learning Outcome – CHE 470 – Chemical Technology** |
|---|---|
| **CLO1** | Understanding the concept of the Nigerian Chemical Industry |
| **CLO2** | Introduction and application of Chemical technology |
| **CLO3** | Identify and use the utilization of raw materials, coal, petroleum, natural gas, air, water, agricultural products and wastes |
| **CLO4** | Apply the concept of manufacturing hydrogen and synthesis gas |

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| **CLO5** | Understanding and applying the Catalytic reforming of hydrocarbons with stream process |
| **CLO6** | Identify and use ammonia, synthesis gas, nitrogenous fertilizers, ethylene |

| No. | **Course Learning Outcome – CHE 471 – Environmental Pollution and Control** |
|---|---|
| **CLO1** | Understand the Principal pollutants and their sources |
| **CLO2** | Apply the concept of other investment return techniques |
| **CLO3** | Understand Air pollution and technological sources of air pollution |
| **CLO4** | Evaluate the Principal pollutants emitted from combustion chambers, particulates, non-combustibles, and un-burn particles |
| **CLO5** | Identify particles formed during combustion gasses, |
| **CLO6** | Understand the Organic pollution combustion to solve environmental pollution |

| No. | **Course Learning Outcome – CHE 483 – Chemical Engineering Laboratory III** |
|---|---|
| **CLO1** | Apply laboratory experiments in transport phenomena |
| **CLO2** | Apply the concept of kinetics in laboratory experiments |
| **CLO3** | Application of separation process |
| **No.** | **Course Learning Outcome – FEG 490 – Students Industrial Work Experience III (SIWES III)** |
| **CLO1** | Introduction to the Industry |
| **CLO2** | Application of Theory knowledge in the Industrial pace |
| **CLO3** | To acquire working experience and knowledge in the Industry |
| **CLO4** | To improve Technical, Practical and experimental performance of the student |

**500Level Courses**

| No. | **Course Learning Outcome – CHE 501 – Loss Prevention in Process Industries** |
|---|---|
| **CLO1** | Understanding and identifying the hazards in chemical process industries |
| **CLO2** | Evaluating and applying of safety process like Hazop techniques in the plants |
| **CLO3** | Identify causes of accidents in process plants and evaluating the prevention measure to avoid accident from occurring or reoccurring. |
| **CLO4** | Apply optimization process and maintenance of plant to minimize losses |
| **CLO5** | Demonstrate the application of Pollution control measure |
| **CLO6** | Evaluating legal implications of various losses |

| No. | **Course Learning Outcome – CHE 539 – Separation Processes III** |
|---|---|
| **CLO1** | Understand the concept of humidification and water-cooling process to solve Engineering problem |
| **CLO2** | Describe and analyze the Solvent Extraction processes |
| **CLO3** | Identify and use the Extractive and azeotopic distillation process |
| **CLO4** | Apply the Multi-component gas absorption and distillation of multi-component mixtures principles |
| **CLO5** | Application of Novel distillation processes to solve Engineering problem |
| **CLO6** | Application of Chromatography |

| No. | **Course Learning Outcome – CHE 554 – Chemical Reaction Engineering III** |
|---|---|
| **CLO1** | Introduction and application of applied catalysis, physical adsorption, and chemisorptions |
| **CLO2** | Application of adsorption isotherms to solve Engineering problems |
| **CLO3** | Use heat of adsorption, selectivity, catalyst preparation methods to solve problems |
| **CLO4** | Identify and use some criteria and test of catalyst performance |
| **CLO5** | Apply the characterization of the physiochemical properties of catalysts, texture and |

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| | acidity of solid catalyst, deactivation of catalysts |
| **CLO6** | Analyze the kinetics and mechanisms of some industrial catalytic processes |

| No. | **Course Learning Outcome – CHE 502 – Chemical Process Optimization** |
|---|---|
| **CLO1** | Apply optimization techniques to formulate and solve practical problems |
| **CLO2** | Apply different numerical methods for optimization of single variable unconstrained functions |
| **CLO3** | Solve unconstrained multivariable optimization problems |
| **CLO4** | Solve linear programming and nonlinear programming problems with constraints using various methods |
| **CLO5** | Analyze typical applications of optimization techniques in chemical process industries |

| No. | **Course Learning Outcome – CHE 567 – Chemical Plant Design** |
|---|---|
| **CLO1** | Generally, the concept of design is brought to light paying more emphasis on chemical process and plant design |
| **CLO2** | Identify problems involving the study of a process |
| **CLO3** | Analyse and prepare flow sheet involving PFD & PID |
| **CLO4** | Prepare heat and mass balance and detailed design of some plant items |
| **CLO5** | Identify and use the application of Economics and Safety consideration |

| No. | **Course Learning Outcome – CHE 573 – Engineering Management I** |
|---|---|
| CLO1 | Manage people, organisation and environment for achieving competitive advantage |
| CLO2 | Critically analyse, evaluate and manipulate management theories and practices |
| CLO3 | Prepare an organizational plan and execute planning process based on the goals and objectives |
| CLO4 | Design organizational structure and establish the relationship among departments. |

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| CLO5 | Demonstrate staffing and related human resource development functions to manage and appraise<br>employees. |
| CLO6 | To understand the practical implications of studying management with regards to the corporate<br>world. Lead employees, subordinates and propose control activities in organizations |

| No. | **Course Learning Outcome – CHE 574– Engineering Management II** |
|---|---|
| CLO1 | Describe the concept of management laying more emphasis on Engineering aspect/role in management |
| CLO2 | Identify forms of business enterprises and financial management |
| CLO3 | Analyse and use accounting principles, standard and marginal costing, budgeting techniques and budgetary control |
| CLO4 | Demonstrate the application of production management, types of production and factors of production for management |
| CLO5 | Application of linear programming, simplex method for optimal conditions to solve Engineering problems |

| No. | **Course Learning Outcome – CHE 581 – Petroleum Refining and Processing** |
|---|---|
| CLO1 | Introduction to the history and development of refining, |
| CLO2 | Identify and use the composition of petroleum and testing methods to solve problems involving the study of a refining |
| CLO3 | Introduction to processing refinery and distillation process |
| CLO4 | Identify and use the fractionation equipment, heat exchangers, tube, still and carrying out chemical treatment |
| CLO5 | Demonstrate the application of design of refining equipment, types of refining products, properties and application |

| No. | **Course Learning Outcome – CHE 582 – Petrochemical Processing and Technology/Petrochemicals** |
|---|---|
| CLO1 | Analyze the sources of petrochemicals, thermal cracking, catalytic cracking and reforming processes |
| CLO2 | Explain the concept behind natural gases, refinery gases and their utilization |
| CLO3 | Analyse the manufacturing processes of methyl alcohol, formaldehyde, hydrocarbons and its use/benefits |
| CLO4 | identify and use chlorination reactions and oxidation processes |
| CLO5 | Manufacturing of soap and detergents, isopropyl alcohol, and acetylene based synthesis |

| No. | **Course Learning Outcome – CHE 583 – Coal Utilization and Processing Technology** |
|---|---|
| CLO1 | Introduction to coal formation, physical and chemical properties of coal |
| CLO2 | Classification and characteristics of coal |
| CLO3 | Analyse the rates of coal pyrolysis and gasification reaction |
| CLO4 | Apply coal combustion method to solve Engineering problem |
| CLO5 | Introduction to the sources of world energy, selected topics in energy conversion, relevance of energy conversion technology to Nigerian economy |

| No. | **Course Learning Outcome – CHE 584 – Energy Conversion Technology** |
|---|---|
| CLO1 | Generally, the concept of energy is brought to light paying more emphasis on various classification and sources of energy |
| CLO2 | Application of thermodynamic consideration to solve Engineering problems |
| CLO3 | Apply Einstein equation in solving problems |
| CLO4 | Study the various types and utilization of energy |

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| CLO5 | Application of alternative energy sources to solve Engineering and world problems |
| CLO6 | Explain the concept of energy conversion processes, energy storage and energy politics |

| No. | **Course Learning Outcome – CHE 597 –Technical Communication (Seminar)** |
|---|---|
| CLO1 | Develop presentation skills and provide transfer of knowledge effectively to an audience |
| CLO2 | Analyze scientific literature for assimilating knowledge |
| CLO3 | Write technical documents and give oral presentations |
| CLO4 | Describe acquired information using a variety of modern presentation tools |
| CLO5 | Identify a current engineering problem of professional interest, analyze it and propose a preliminary work plan to solve it. |

| No. | **Course Learning Outcome – CHE 585 – Electives** |
|---|---|
| CLO1 | Understand Chemical Engineering concepts in Biomedical systems |
| CLO2 | Metallurgy and corrosion control |
| CLO3 | Chemical Process Synthesis and Simulation |
| CLO4 | Introduction to Nuclear Chemical Engineering |
| CLO5 | Glass and Ceramics Technology |
| CLO6 | Food Processing Engineering |
| CLO7 | Pharmaceutical Technology |
| CLO8 | Reservoir Engineering |
| CLO9 | Petroleum Geology, Petroleum exploration, crude oil production, Pollution control and Natural Gas Production |

| No. | **Course Learning Outcome – CHE 586 – Biochemical Engineering II** |
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| **CLO1** | Describe the principles of biotechnology |
| **CLO2** | Analyze the methods of genetic modification of prokaryotic and eukaryotic organisms, to optimize biochemical characteristics and to stabilize cellular |
| **CO3** | Application of structure transformation transduction, conjugation and protoplasm fusion |
| **CLO4** | Understand the advantages and method of induced phage virus bacterial plasmid or vector DNA mapping techniques |
| **CLO5** | Application of the present and future prospect of utilization of created gene pools in selected topics of application areas |
| **CLO6** | Apply the Microbial enzyme technology, bioreactor design, practice of post-harvest technology and agricultural waste recycling system and process. |

| No. | **Course Learning Outcome – CHE 588 – Polymer Science and Technology/Engineering** |
|---|---|
| **CLO1** | Understand the concept of polymer and their characteristics |
| **CLO2** | Study the source of monomers, structure and physical properties of polymers |
| **CLO3** | Apply the William Landel Ferry equation in solving complex Engineering problems |
| **CLO4** | Introduction to polymerization reactions and manufacturing methods |
| **CLO5** | Study the Ziegler Natta Catalysis, processing and technology of polymers |

| No. | **Course Learning Outcome – CHE 599 – Research Project** |
|---|---|
| **CLO1** | Ability to effectively gather and interpret information from literature survey. |
| **CLO2** | Ability to use knowledge gathered through literature survey to identify, formulate, analyze and solve complex problems and to evaluate and interpret various solutions |
| **CLO3** | Gain the ability to communicate effectively with written, oral, and visual means in a technical setting |
| **CLO4** | Ability to use modern techniques of characterization and analysis of materials |

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| **CLO5** | Students will be able to carry out calculations involved in syntheis, characterisation, and evaluate alternate assumptions, approaches, and procedures. Ability to fabricate system components related to engineering problems giving consideration to environment and society |
| **CLO6** | Complete an independent research project, resulting in at least a thesis publication, and research outputs in terms of publications in SCI indexed journals and conference proceedings |

## STAFF LIST

### ACADEMIC STAFF

| S/N | NAME | RANK | COREN NO. |
|---|---|---|---|
| 1. | Engr. Dr. Omotioma Monday | HOD, Senior Lecturer | R.27479 |
| 2. | Engr. Prof. G. O. Mbah | Dean, Professor | R.23631 |
| 3. | Engr. Prof. T. O. Chime | Professor | R.13761 |
| 4. | Engr. Rev. Prof. S. O. Egbuna | Professor | R.29615 |
| 5. | Engr. Prof. P. C. N. Ejikeme | Professor | R.34511 |
| 6. | Engr. Dr. B. C. Udeh | Associate Professor | R.13172 |
| 7. | Engr. Dr. E. M. Ejikeme | Senior Lecturer | R.30343 |
| 8. | Engr. Dr. K.C. Ugwu | Senior Lecturer | R.25714 |
| 9. | Engr. Dr. Eze Paul | Senior Lecturer | R. 32683 |
| 10. | Engr. Dr. Chinwetau J.U. | Senior Lecturer | R.36821 |
| 11. | Engr. Dr. Okeke G.C. | Senior Lecturer | R.37172 |
| 12. | Engr. Dr. Agbo A. | Senior Lecturer | R.30144 |
| 13. | Engr. Dr.Odenigbo C. | Senior Lecturer | R.33676 |
| 14. | Engr. Dr. Ugwuanyi D.C. | Senior Lecturer | R.33746 |
| 15. | Engr. Dr. Ozonoh Maxwell | Lecturer I | R.25640 |
| 16. | Dr. K. A. Eze | Lecturer I | IN PROGRESS |
| 17. | Engr. Dr. Onoh Maxwell Ikechukwu | Lecturer I | R.37259 |
| 18. | Dr. Aniokote Thomas Chinedu | Lecturer I | R.25100 |
| 19. | Engr. J. O. Okoye | Lecturer I | R.38242 |
| 20. | Engr. C. O. Nevo | Lecturer I | R.55458 |
| 21. | Engr. Okorie Onuora | Lecturer I | R.39348 |
| 22. | Engr. Mrs. O. S. Aliozor | Lecturer II | R.34213 |
| 23 | Engr. Mrs. Ekete Juliet Azuka | Lecturer II | R.34519 |
| 24 | Engr. Agu Frank | Lecturer II | R.63834 |

**LABORATORY STAFF**

| S/N | NAME | DESIGNATION OF APPOINTMENT | QUALIFICATIONS |
|---|---|---|---|
| 1. | Engr. Dr. David O. Abraham | Chief Technologist | Ph.D 2021<br>M.Eng 2004<br>MBA 2004<br>PGD 1996<br>HND.1981 |
| 2. | Engr. Dr. Inyiama Fidelis Chidozie | Chief Technologist | Ph.D 2022<br>M.Sc 2013<br>M.Eng 2004<br>B.Eng 1988 |
| 3. | Owo Bartholomew Chijioke | Chief Laboratory Supervisor | PGD 2007<br>HND 1996<br>OND 1991 |
| 4. | Aguegwu Agatha Ogbuanya | Senior Technologist | PGDE 2013<br>B.TECH 2006 |
| 5. | Offia Kingsley Nebechi | Senior Technologist | M.Eng 2014<br>B.Eng 2006 |
| 6. | Okeke Elochukwu Chinonso | Laboratory Technologist | M.Eng 2016<br>B.Eng 2011 |
| 7. | Okonkwo Gloria Ngozi | Asst. Chief Technologist | M.Eng 2014<br>PGDE 2006<br>B.Eng 1996 |
| 8. | Ozoeze Eric | Asst. Chief Technologist | M.Eng 2014<br>B.Eng 2004 |
| 9. | Ugwu Ogochukwu Gordian | Senior Technologist | M.Eng 2020<br>B. Eng 2011 |
| 10. | Eze Kenneth Chidiebere | Technologist 1 | PGD 2021<br>PGDTE 2016<br>HND 2012<br>ND 2008 |
| 11. | Umeh Cecilia Chidera | Technologist I | B.Eng 2000 |
| 12. | Ozoagbodo Remigus | Technologist I | B. Eng 2003 |
| 13. | Eze Bridget Uche | Chief Lab. Supervisor | WASC 1982<br>F.S.L.C 1975 |
| 14. | Nwafor Matthew | Chief Laboratory Supervisor | WASC 1980<br>F.S.L.C 1975 |

**ADMINISTRATIVE STAFF**

| S/N | NAME OF STAFF | RANK/DESIGNATION |
|---|---|---|
| 1. | Mrs. Ezinwa Gloria Ijeoma | ACEO |
| 2. | Mrs. Bessy Ozoanoh | Chief Caretaker |
| 3. | Mr. Samuel Onah | Secretary |