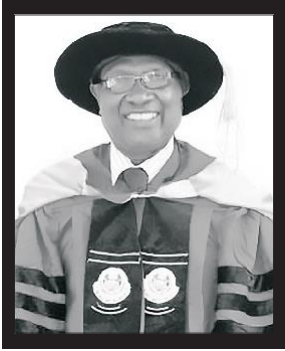
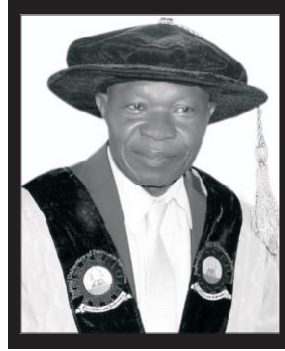


PAST AND PRESENT DEANS



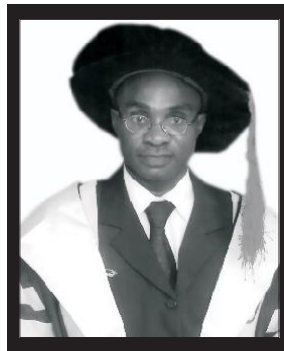
ENGR. PROF. ABIOLA KEHINDE
DEC. 2010 - SEPT. 2011



ENGR. PROF. OLATUNDE DAMISA
SEPT. 2011 - MAY 2013



ENGR. PROF. I. C. AJUWA
JULY 2014 - NOV. 2014



ENGR. DR. C. O. IZELU
MAY 2013 - JULY 2014
NOV. 2014 - JULY 2016



ENGR. PROF. C. N. OWABOR
JULY 2016 - JUNE 2020



ENGR. DR. G. OFUALAGBA
JULY 2020 TO DATE

COLLEGE BUILDING/LABORATORIES



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CHAPTER ONE

INTRODUCTION

VISION

The vision of the College of Engineering and Technology in FUPRE is to be recognized as a world class college that would provide excellence and leadership in engineering education, training, research, consultancy and extension services for the petroleum and allied sectors.

MISSION

The mission of College of Engineering and Technology in FUPRE is to graduate well-trained engineers who would be relevant, capable of leading and managing changes through integration, application and transfer of engineering knowledge in the Oil, Gas and Energy industry of the country and beyond.

PHILOSOPHY

The programs of College of Engineering and Technology are designed to meet the challenges of the Oil, Gas and Energy sectors in the 21st century through the enhancement of student's preparation for professional careers, life-long learning and responsible participation as members of the larger society. The programs are also structured so that the students will have sound knowledge of engineering and other related disciplines so that the engineer can work effectively with other engineers, scientists, technologist, technicians and craftsmen in fulfilling engineering assignments.

COLLEGE PROGRAMMES

The undergraduate programs of the College of Engineering and Technology

Provide students with a range of educational opportunities by which they may achieve competence in major branches of engineering. The branches of engineering being currently run by the college are:

- Ø Chemical Engineering
- Ø Civil Engineering
- Ø Computer Engineering
- Ø Electrical and Electronics Engineering
- Ø Marine Engineering
- Ø Mechanical Engineering
- Ø Natural Gas Engineering
- Ø Petrochemical Engineering
- Ø Petroleum Engineering

Equipped with the knowledge of mathematics, physical sciences, computational techniques, statistical analysis of data, and engineering sciences, the engineer can engage in creative design and construction, synthesis of systems, and in research and development. Thus the engineer serves as a bridge between meeting human needs and the storehouse of scientific knowledge. stipulated in the UTME Regulations. That is, all applicants must possess a minimum of five (5) credit passes in either WAEC or NECO ordinary level English, Mathematics, Physics and Chemistry examinations and any one of the following subject: Further Mathematics, Biology, Agricultural Science and Technical Drawing, Economics, Geography and Fine and Applied Art. In addition, applicants must obtain cut-off points in UTME and PUTME (or equivalent) for the degree programme in the same cluster of subjects.

DEAN'S STAFF LIST

S/N	NAME OF STAFF	CADRE	QUALIFICATION	SPECIALIZATION	APPOINTMENT
1	G. Ofualagba	Reader	PhD; M. Eng; B.Eng, COREN,	Renewable Energy Systems, Robotics and Automation	Permanent Ag. Dean, College of Engineering and Technology
2	E. C Onyeneka	Senior Assistant Registrar	LL.B, BL		Permanent.
3	B. Bunu	Assistant Registrar	B.A		Permanent
4	S. Gabriel	Assistant Registrar	B.Sc		Permanent
5	U. J. Osuji	Principle Executive Officer II	HND		Permanent
6	E. Eruotor	Admin Assistant	B.Sc/Edu		Permanent
7	L. I. Musah	Principle Permanent Secretary	HND		Permanent

CURRICULAR REQUIREMENTS

The general College of Engineering and Technology curriculum is structured to include the following features.

COMMON FRESHMEN YEARS

In spite of the fact that students are required to declare their fields of major study at the point of entry into the college, all the students in the college run a common freshman courses for the first two years. The curriculum for the 100 level contains a number of specially designed courses in and basic sciences to provide students with firm background in physical sciences and mathematics. This also includes courses in general chemistry and physics. These courses are designed and handled by College of Sciences for College of Engineering and Technology.

Clear and precise communication skills, oral and written, are required of an engineer who delivers judgments, plans and makes decisions. For these reasons, the students are required to offer courses in Communication Skills in English, Humanities and Entrepreneurship.

ENGINEERING DEPTH

About one full year (Final year) is devoted to the student's major field of engineering. Most of the courses in this category are specified courses designed to give the student the essential subject materials in his/her major. In this final year, every student takes a course leading to an integrated design project where the student uses his engineering and design skills in planning and designing a real world engineering project. The design should take into consideration appropriate constraints such as economic factors, safety, reliability, ethics, environmental and social impact.

GRADUATION REQUIREMENTS

In order to qualify for graduation from the College of Engineering and Technology, students must:

- (i) complete all required and elective courses in the selected degree programme with a cumulative GPA of 1.50 or better.
- (ii) Complete successfully after 4th year, a 6-month compulsory programme working in the students industrial work experience scheme (SIWES).

GRADING SYSTEM

The grading system adopted by the College is as shown in the table below.

Mark	Letter	Grade Point	Equivalent
70 - 100	A	5	Excellent
60 - 69	B	4	Very Good
50 - 59	C	3	Good
45 - 49	D	2	Pass
40 - 44	E	1	Poor Pass
Below - 40	F	0	Fail

CLASSIFICATION OF DEGREES

A Grade Point Average (GPA) is calculated for each level of courses with appropriate weighing according to the number of credits attached to each course. The final grade is calculated from the sum of the GPA with appropriate weighing for each level of courses.

The class of degree is determined by the final weighted grade point average of final weighted grade (FWG) as follows:

Class of Degree	FWG
First Class Honours	4.50 - 5.00
Second Class, Upper Division	3.50 - 4.49
Second Class, Lower Division	2.50 - 3.49
Third Class	1.50 - 2.49
Pass	1.00 - 1.49
Fail	Below 1.00

REQUIREMENTS FOR WITHDRAWAL

Any student who makes Cumulative Grade Point Average (CPGA) of less than 1.50 for two consecutive semesters will be advised to withdraw from the College on the ground of poor academic performance.

REQUIREMENTS FOR PROBATION

Any student who makes a Cumulative Grade Point Average (CGPA) of less than 1.50 for one semester will be placed on probation.

EXAMINATIONS

All courses are assessed using examinations; continuous assessments and laboratory/practical work at the end of each semester, UBITS, laboratory courses, workshop practice courses. Seminar courses and projects are, however, assessed on the basis of written reports and/or oral defense.

EXAMINATION OFFENCES

- i. A candidate shall not be allowed, during an examination, to communicate by word, or otherwise with any other candidates nor shall he be allowed to leave his place except with the consent of an invigilator. Should a candidate act in such a way as to disturb or inconvenience other candidates,

he shall be warned; and if he persists, he may, at the discretion of the invigilator be reported in writing through the Head of Department to the Vice Chancellor within 24 hours.

- ii. It shall be an examination offence for any student, staff or any person whatsoever to impersonate a candidate in any University examination. Any student or staff of the University found guilty under this regulation shall be subjected to disciplinary action by the appropriate authority of the University. The candidate impersonated shall also be liable for an infraction for this regulation where it is established from circumstantial evidence that the impersonation is with his knowledge connivance.
- iii. No candidate shall take into an examination room or have in his possession, during an examination any book or paper or printed or written document, whether relevant to the examination or not, unless specifically authorized to do so. An invigilator has authority to confiscate such documents.
- iv. Mobile phones are not allowed in examination halls.
- v. A candidate shall not remove from an examination room any paper, used or unused, except the question paper and such book and paper, if any, as he is authorized to take into the examination room.
- vi. Candidates shall comply with all “direction to candidates” set out on an examination answer book or other examination materials supplied to them. They shall also comply with direction given to them by an invigilator.

- vii. Candidates shall not write on any paper other than the examination answer books. All rough work must be done in the answer books and crossed out neatly. Supplementary answer books, even if they contain only rough work must be tied to the main answer books.
- viii. When leaving the examination room, even if temporary, a candidate shall not leave his written work on the desk but he shall hand it over to an invigilator. Candidates are responsible for the proper return of their written work.
- ix. Smoking shall not be permitted in examination room during examination sessions.
- x. Any candidate or staff who attempts in any way to unlawfully have or give pre-knowledge of an examination question or to influence the marking of scripts or the award of marks by the University examiner shall be subjected to disciplinary action by the appropriate authority of the University.
- xi. If any candidate is suspected of cheating, receiving assistance or assisting other candidates or of infringing any other examination regulation, a written report of the circumstance shall be submitted by the invigilator to the Vice Chancellor within 24 hours of the examination session. The candidate concerned shall be allowed to continue with the examination.
- xii. Any candidate suspected of examination malpractice shall be required to submit to the invigilator a written report immediately after the paper. Failure to make a report shall be regarded as a breach of discipline. Such report should be

forwarded along with the invigilator's report to the Vice Chancellor.

- xiii. Where a Head of Department fails to forward a report on examination malpractice to the Vice Chancellor, such action would be considered as misconduct.
- xiv. Where the Vice Chancellor is satisfied on the bases of the report forwarded to him that any candidate has a case to answer he shall refer the case to the Student Disciplinary Committee.

PENALTIES FOR EXAMINATION MALPRACTICE AND OTHER OFFENCES

- i. Any examination offence would attract penalty including outright dismissal from the University.
- ii. Where the Vice Chancellor has reason to believe that the nature of any question or the content of any paper may have become known before the date and time of the examination to any persons other than the examiners of the paper, the Board of Examiners, and any official of the University authorized to handle the paper, he may order the suspension of the examination or the cancellation of the paper or setting of a new paper and shall report the matter to Senate. The Vice Chancellor shall also take any disciplinary measure against any student or students involved as he may deem appropriate.
- iii. If in the opinion of an invigilator, circumstances arise which render the examination unfair to any candidate he must

report the matter to the Vice Chancellor in writing 24 hours after the examination. Where such matter is reported to the Vice Chancellor, he may take such action as he deems fit. If he directs that another examination be held, that examination shall be the examination for the purpose of this regulation.

- iv. Any candidate or member of staff may complain to the Vice Chancellor that an examination has been improperly conducted. The Vice Chancellor shall investigate the complaint and report the result of his investigation to the Senate which shall take such action as it may deem appropriate, including with-holding a result or deprivation of the award of a degree, diploma, etc as laid down by the University rules.

HOW TO PLAN FOR AND SURVIVE EXAMINATIONS

All the examinations are planned by the Examination Committee in FUPRE with inputs from Departments. Because of the wide range of options, it is impossible to please everyone all of the time during the examinations. You may find that all your examinations are scheduled close together with no substantial break in between. The important thing is not to panic. Listed below are a few hints, which might make your examination period a little less stressful.

BEFORE EXAMINATION

- (i) check its date, time and location
- (ii) know how long it will take you to get to the hall
- (iii) ensure you have the required implements (pens, pencils, non programmable calculator, etc.)
- (iv) remember your College identification card (very important) and examination timetable.

Do not take anything into the examination hall which could be misconstrued as helping you in the examination e.g. small slips of paper with equations written on them, or anything written on your hands. FUPRE is very determined to eliminate cheating and will certainly act vigorously if such events are detected. You could be removed from the College without ever being allowed to finish your degree studies.

AT THE EXAMINATION

- A Read the instructions at the head of the paper, taking particular note of:
- ∅ the number of questions to be answered;
 - ∅ whether the paper is in sections, the number of questions to be answered from each section;
 - ∅ the time to be spent on each question;
 - ∅ whether or not each new question has to be started on a new page of the answer book.
- B decide which questions you are going to attempt, trying to rank them in order of easiness, and answer them in this order;
- C do all the parts you can of all the questions you decide to answer;
- D if you get completely stuck on part of a question, do not pursue it whilst there are other questions that you know you can answer; you can always come back to these questions later, if time permits;
- E most questions are in several parts and each part carries marks – even if you are unable to tackle the whole of a question, always make an attempt to do as much of it as you can and clearly identify which part you are answering;
- F It is unlikely that your handwriting will be at its best under examination conditions, but the examiner cannot give marks

for an answer that cannot be deciphered – try to write as clearly as you possibly can;

- G never leave an examination before time is up; even if you have done very little, there may be more marks to be had by polishing and thinking more about the questions;
- if you are in danger of running out of time, quickly sketch a skeleton of the answer you would have given; it may earn you a few more marks.

BACHELOR DEGREE PROGRAMMES**100 LEVEL COURSE STRUCTURE AND CONTENT COMMON TO ALL DEPARTMENTS.**

FIRST SEMESTER							
COURSE CODE	COURSE TITLE	L	T	P	CREDIT UNIT	STATUS	
CHM 111	General Inorganic Chemistry	2	1	-	3	C	
CHM 112	General Physical Chemistry	2	1	-	3	C	
MTH 111	General Mathematics I	2	1	-	3	C	
MTH 112	Data Analysis	2	-	-	2	C	
PHY 111	General Physics I	2	1	-	3	C	
PHY 119	Experimental Physics I	-	-	3	1	C	
GSE111	Communication in English I	2	-	-	2	C	
GSE112	Use of Library	1	-	-	1	C	
GSE113	Philosophy and Logic	2	-	-	2	C	
TOTAL CREDIT UNITS					20		

SECOND SEMESTER						
COURSECODE	COURSE TITLE	L	T	P	CREDIT UNIT	STATUS
CHM 121	General Organic Chemistry	2	1	-	3	C
CHM 129	Practical chemistry	-	-	3	1	C
MTH 121	General Mathematics II	2	1	-	3	C
MTH 123	Vectors and Dynamics	2	1	-	3	C
PHY 121	General Physics II	2	1	-	3	C
PHY 122	Heat and Properties of Matter	2	-	-	2	C
PHY 129	Experimental Physics II	-	-	3	1	C
GSE 121	African Culture, Civilization, and Nigerian People	2	-	-	2	C
GSE 122	Communication in English II	2	-	-	2	C
GSE 123	Peace and Conflict Resolution	2	-	-	2	C
GSE 124	History and Philosophy of Science	-	-	-	-	C
TOTAL CREDIT UNITS					22	

CHM 111: General Inorganic Chemistry 3 UNITS

Electronic configuration, periodicity and building up of the periodic table. Hybridization and shape of simple molecules. Natural occurrence and extraction of metals of groups Ia -IVa. Comparative chemistry of groups IA -IVa elements. An introduction to transition metal chemistry and nuclear chemistry.

CHM 112: General Physical Chemistry 3 UNITS

Atoms, molecules and structures: The structure of atoms, protons, neutrons and electrons. Atomic mass unit (amu), atomic number and mass number. Molecules and moles. Elements and atomic symbols. Isotopes, atomic weights and naturally occurring average atomic weights. Binding energy.

Bonds and Intermolecular forces: Covalent bonds, molecular structure and molecular weights. Forces between molecules. Van der Waals attractions. Polar attractions, Electronegativity and hydrogen bonds. Kinetic theory of matters. Avogadro's number. Acids, bases and salts. Redox reactions. Ions, ionization, cations and anions. Oxidation and reduction. Simple and complex ions. Coordination number. Melting and boiling points of salts.

Ions in solution: Hydration, conduction of electricity and electrolysis. Faraday's laws of electrolysis. Electrodes. Anodes and cathodes. Gaseous ions. Discharge tubes, cathode rays. Millikan's oil-drop experiment, e/m and e . mass spectrometry, elementary thermochemistry reaction rates.

MTH 111: General Mathematics I 3 UNITS

Trigonometric functions of angle of any magnitude, addition and factor formulae.

Complex Numbers - Sum, difference, product and quotient of complex numbers, polar form, Argand diagram, locus problems, De Moivre's theorem. Elementary set theory, subsets, union, intersection and Venn diagram. Real numbers: integers, rational and irrational numbers. Mathematical induction, real sequences and series. Theory of quadratic equations, Partial Fractions and binomial theorem.

MTH 112: Data Analysis 2 UNITS

Data collection, presentation and EDA -Sample surveys, experiments and observational studies. Scales of measurement. Frequency distributions and diagram including bar charts, histogram, and scatterplots. Sample statistics (mean, median, mode, range, standard deviation, coefficient of variation, quartiles, skewness, kurtosis, product moment and rank correlation, index numbers).

Estimation and Inference - Sampling distributions. Distribution of sample means and proportions, variances. Confidence intervals. Testing the value of single sample means, proportions and variances. comparing two means,

proportions, variances. Chi-squared test of association and homogeneity.

PHY 111: General Physics I

3 UNITS

Space and Time, Units and dimension, Kinematics; Fundamental Laws of Mechanics, statics and dynamics; work and energy; Conservation laws. Elasticity; Hooke's law, Young's shear and bulk moduli, Hydrostatics; Pressure; buoyancy Archimedes' Principles. Surface tension; adhesion, cohesion, capillarity, drops and bubbles. Rotational dynamics, equilibrium of rigid bodies, Oscillation, gravitation.

PHY 119: Experimental Physics I

1 UNIT

This introductory course emphasizes quantitative measurements, the treatment of measurement 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.

GSE 111: Communication in English I

2 UNITS

Effective communication in English. Language skills in listening, speaking, reading and writing. aspects of sound patterns in English, units of grammar, types and functions of clauses, composition, types and functions of paragraph, punctuation marks, direct and indirect reported speech. Voice: active and passive, tense, concord/agreement, interpretation. Exercises in reading comprehension, writing and listening. Phonetics, art of public speaking and oral communication, figures of speech. Research skills, writing of term papers and research papers.

GSE 112: Use Of Library

1 UNIT

History of libraries, library and education, university libraries and other types of libraries; study skills (reference services), types of library materials, using library resources including e-learning, e-materials etc.; understanding library catalogues and classification; copyrights and its implications, database resources, bibliographic citations and referencing.

GSE 113: Philosophy and Logic **2 UNITS**

Introduction to the nature of philosophy; its scope problems and key concepts. The nature of logic. Deductive and inductive logic. Affirmative and negative propositions. Universal, particular, singular propositions. The four standard proposition of logic. Distribution of terms. Middle, major and minor terms. Rules for determining validity and invalidity. Translating ordinary into logical sentences and fallacies.

CHM 121: General Organic Chemistry 3 UNITS

Classification of organic compounds; Functional groups and homologous series; Isolation and purification of organic compounds; determination of structure of organic compounds; Isomerism: structural, stereoisomers, cis and trans geometrical isomerism; Nomenclature of simple organic compounds; Chemistry of simple hydrocarbons - alkanes, alkenes, alkynes and benzene; Polar compounds: alcohols, aldehydes, ketones, carboxylic acids and amines (general preparations, reactions and uses).

CHM 129: Practical Chemistry 1 UNIT

Laboratory Safety Regulations, Accidents and First Aid in the Laboratory, Record Book, Qualitative Analysis - Preliminary Investigations, Test for acidic radicals (Anions), Test for metallic radicals (Cations); Quantitative Analysis - Volumetric or Titrimetric Analysis

MTH 121: General Mathematics II 3 UNITS

Functions of a real variable and their graphs. Treatment of limits and continuity.

Derivatives as limits of rate of change. Differentiation techniques, including products, quotients, etc.

Extreme curve sketching, Partial Derivative. Integration as an inverse of differentiation. Methods of integration. Integration techniques including substitution, parts and partial fractions. Differentiation and integration of logarithm and exponential functions, trigonometric and hyperbolic functions and their inverses. Definite integrals. Application to areas and volumes.

MTH 123: Vectors and Dynamics 3 UNITS

Geometric representation of vectors in 1-3 dimensions, components, direction cosines. Addition and scalar multiplication of vectors. Scalar and vector products of two vectors. Differentiation and integration of two vectors with respect to a scalar variable. Two-dimensional co-ordinate geometry. Straight lines, circles, parabola, ellipse, hyperbola. Tangents and normals. Kinematics of a particle. Components of velocity and acceleration of a particle moving in a plane. Force, momentum, laws of motion under gravity. Projectiles resisted vertical motion, elastic string, simple pendulum impulse. Impact of two smooth spheres and of a sphere on a smooth sphere.

PHY 121: General Physics II 3 UNITS

Electrostatics; conductors and currents; electric field, Gauss's law, Electric potential, Capacitor and dielectric, Electromotive force and circuits. Magnetic fields and induction. Ampere's law, Faraday's law of induction: Maxwell's equations; electromagnetic oscillations and waves; Applications.

PHY 122: Heat and Properties of Matter 2 UNITS

Temperature, thermometry, Heat and heat measurements, gas laws. Thermal properties of matter, Molecular theory of matter. Kinetic theory of gasses. Heat transfer. Prevost theory of heat exchange. Thermal radiation detectors; Optical pyrometer, Laws of thermodynamics.

PHY 129: Experimental Physics II 1 UNIT

This introductory course emphasizes quantitative measurements, the treatment of measurement 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, PHY 121.

GSE 121: African Culture, Civilization, and Nigerian People 2 UNITS

The individual, society, environment, language, ethnicity, race and culture; dynamics of culture change with reference to cultural and social history vis-à-vis archaeological studies; African cultural heritage and progress from the earliest times to the present with special mention of features such as farming, metallurgy, trade, urban and rural life. Rural and urban life in Nigeria with emphasis on the socio-cultural and ecological factors predisposing to the rural-urban dichotomy, family, economics, politics and belief systems.

GSE 122: Communication In English II 2 UNITS

Effective communication in English Language skills in listening, speaking, reading and writing. Aspects of sound patterns in English, units of grammar, types and functions of clauses, composition, types and functions of paragraph, punctuation marks, direct and indirect reported speech. Voice: active and passive, tense, concord/agreement, interpretation. Exercises in reading comprehension, writing and listening. Phonetics, art of public speaking and oral communication, figures of speech. Research skills, writing of term papers and research papers.

GSE 123: Peace and Conflict Resolution 1 UNITS

Basic Concepts in peace studies and conflict resolution, Peace as vehicle of unity and development, Conflict issues, Types of conflicts, e.g. Ethnic/religious/political/economic conflicts, Root causes of conflicts 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 organisations in conflict resolution, e.g. ECOWAS, African Union, United Nations, etc.

GSE 124: History and Philosophy of Science**1 UNITS**

Man - his origin and nature: man and his cosmic environment, scientific methodology, science and technology in the society and service of man; renewable and non-renewable resources - man and his energy resources. Environmental effects of chemicals, plastics, textiles, wastes and other materials. Chemical and radio chemical hazards. Introduction to the various areas of science and technology.

COMMON COURSES FOR 200-500 LEVEL**200 LEVEL****EEE 211: BASIC ELECTRICAL ENGINEERING I****2 UNITS**

SI Systems of Units; electrostatic and electromagnetic fields: Electric Field Intensity, Potential and Potential Difference, Magnetic Field Intensity, Flux and Flux Density, Magnetic Circuits, Inductors; dc circuit analysis: Kirchoff's Law, Mesh and Nodal equations, Superposition Theorem, Thevenin's Theorem, Norton's Theorem, Maximum Power Transfer, Transients (RL and RC) Circuits; ac circuit analysis: Alternating current, voltage, frequency, phase angle; maximum, rms and average values of waveforms. Inductive and capacitive reactances; power in ac circuits; use of complex algebra in the solution of ac circuits; Resonance; transformers and ac/dc machines: Principles of operation;

circuit models for transformers and dc machines; three phase ac systems: Three phase balanced system; Delta/Star connections; Line and Phase voltages and currents; measurement: Electric current, voltage, frequency and power measurements; measurement of resistance, capacitance and inductance; bipolar and field effect transistors-biasing, dc characteristics, Diode characteristics and diode rectifiers (single phase and three phase); zener diodes and its regulating characteristics.

GET 211: ENGINEERING MATHEMATICS I**3 UNITS**

Basic theory and calculation methods of limit, continuity and differentiation; Introduction to linear first order differential equations (ODEs); partial derivatives; differentials; total differentials; application to approximate computations; high-order partial derivatives and differentials; differentiation of composite and implicit functions of several variables; extrema and conditional extrema; change of variables; matrices and determinants; Engineering applications of matrix algebra; vector algebra, vector calculus, directional

derivatives; Applications Engineering analysis and methods with MATLAB.

GET 212: ENGINEER-IN-SOCIETY 2 UNITS

History of Engineering and Technology; Philosophy of Science; development of Engineering industry up to the present day; safety and health at work; the role of Engineers in Nation Building; food production, housing, transportation, employment opportunities, energy supply, communication and social infrastructure, etc; the choice of engineering solutions and decision-making process; risk analysis, etc; Registration of Engineers; duties and code of conduct and practice; ethics, professional responsibilities and practice of engineering in Nigeria; typical problems and solutions in various areas of Engineering; Engineering projects, planning, feasibility studies and their relevance; guided predesign survey and stages of Engineering design projects; lectures by invited professionals.

GET 219: ENGINEERING LABORATORY I 2 UNITS

Assigned laboratory exercises to reflect the basic engineering courses in Engineering Mechanics, Engineering Materials, Fluid Mechanics, Electrical/Electronics, Thermodynamics; various Lecturers will provide guidance on specific experiments and calculations

MEE 211: ENGINEERING DRAWING I 2 UNITS

Introduction to drawing instruments, scales, grafting aids and their proper use; size of paper and drawing layout; dimensioning, line work and lettering; geometric construction and engineering graphics; development of geometrical figures and intersection of solids and curves; introduction to projection.

MEE 212: ENGINEERING MECHANICS I 2 UNITS

Vectors: Coordinate systems; vector representation; vector algebra. **Statics:** Force systems and free-body diagrams; resultant of coplanar force systems; resultant of spatial force systems; equilibrium of coplanar and spatial force systems. **Kinematics of particles:** Displacements, velocities and accelerations; relative displacements, velocities and accelerations; vector representation of displacements, velocities and accelerations. **Kinematics of rigid bodies:** Types of motion, relative motion between two points on a rigid body; Velocity and acceleration diagrams and images applied to simple mechanisms; instantaneous center of rotation; motion of simple spur gears; epicyclic motion. Computer algorithm, programs and packages for studying vectors,

statics and kinematics of particles and rigid bodies.

MEE 213: BASIC MANUFACTURING TECHNOLOGY 2 UNITS

Introduction to basic manufacturing processes; organization of workshop; workshop hazard, safety practice and code; properties of engineering materials; bench-work and fitting; introduction to turning- straight and step turning, chamfering, screw cutting; milling; drilling techniques; sheet metal work; welding, brazing and soldering technique; foundry techniques; properties of wood; wood work and joinery; workshop measurements

Introduction to CAD/CAM: History, Benefits, Market trends, Role of Computers, Computer Aided Engineering, and Computer Aided Manufacturing. Hardware and software of CAD/CAM: types of system, systems evaluation criteria, input and output devices, graphics standards, modes of graphics operations, user interface.

MEE 214: ENGINEERING MATERIALS 2 UNITS

A topic Structure: review of atomic structure and bonding in materials; atomic and molecular structure; molecular, crystals and amorphous structure; metallic state; defects in crystals; electronic structures and processes (conductors, semi-conductors and insulators). Alloy Theory: A simplified introduction to alloy theory illustrated by the Pb-Sn and Fe-C system; Application to industrially important alloys. Engineering properties of materials; control of these properties through changes in structure due to hot and cold-working of metals, heat-treatment of steel, annealing, etc; failure of metals due to creep, fracture and fatigue; corrosion and corrosion control. Non-Metallic Materials: Non-metallic materials and their properties (glass, natural and synthetic rubber, plastics, ceramics and wood). Elastic and plastic deformations; Defects in metals.

MEE 215: Fluid Mechanics I

Fluid properties; concept, definitions and basic equations fluid statics, kinematics and dynamics; concept, definition and flow characteristics of system and control volume; continuity, energy and momentum equations and their applications; introduction incompressible viscous flow of Newtonian fluids I pipes-pressure drop and shear stress in pipe flows, velocity distribution, Raynolds number and its significance; flow measurement; dimensional analysis.

MEE 216: BASIC THERMODYNAMICS 2 UNITS

Basic concepts- heat, work, system, state, reversible and irreversible processes; Thermodynamic properties of gases and vapours, thermodynamics tables; 1st and 2nd Laws of thermodynamics; Basic thermodynamics processes (Non-flow and Flow Processes); Ideal cycles(Carnot, Otto, diesel and dual cycles).

PEE 211: Introduction to oil and Gas Industry

Overview of the petroleum industry: its history, technical achievements, role in the global economy and future prospects (Global distribution of oil and gas reserves, Distribution of Energy and Hydrocarbons in Nigeria); A brief introduction to modern exploitation, production and processing operations as well as highlights of the petroleum industry in Nigeria and the Gulf Guinea.

CVE 221: BASIC CIVIL ENGINEERING 2UNITS

Engineering Survey and Photogrammetry: Introductory Engineering Survey, Principles and application; survey instruments, types and uses of leveling instruments, tocometres, staff, theodolite, chain, paules and setting up of various instruments; Leveling and traverse: reading, computations, errors, corrections, and distributions, measurements of angles, plotting of profiles, cross section, contours, detailed survey etc; area and volume calculations: Area by trapezoidal and Simpsons 1/3 rule etc; National Grid System and coordination; Bench mark etc

Soil Mechanics: Soil formation and nature: definition, types and phases, particle shape and clay minerals and properties; soil classification: various methods, particle size distributions, Atterberg limits, shape, density and moisture content, porosity, shrinkage and other properties and their relationship grading curves and their interpretation.

Engineering Geology: Definition and application to Civil Engineering; introduction to geologic structures and mappings, sections and structures; rock and minerals: types and formation, properties and classification, content and composition, faults and classification of faults, formation and causes, weathering and erosion processes; stratigraphy: time scale, fossils and their application, introduction to geophysics, seismic, radiometric, electrical and magnetic method; field trip

EEE 221: BASIC ELECTRICAL ENGINEERING II 2 UNITS

Semiconductor materials, bipolar and field effect transistors-biasing, DC characteristics, diode characteristics and diode rectifiers, Zener diodes and its regulating characteristics.

Digital electronics: number systems and codes, logic gates and Boolean algebra, combinational circuits.

GET 221: ENGINEERING MATHEMATICS II 3 UNITS

Surface and curves in space, cylinders, cones and surface of revolution; first- and second-order algebraic surfaces, ellipsoids, hyperboloids and paraboloids; systems of linear equations, determinants, minors and cofactors, and evaluation methods; vector space, linear spaces, Euclidean spaces, orthogonality, change of basis, inverse matrix,

eigenvectors and eigenvalues of a matrix, and rank of a matrix; linear mappings, symmetric matrices, linear and quadratic forms; differentiation and integration of matrices; Engineering applications of matrix algebra.

EEE 222: INFORMATION TECHNOLOGY IN ENGINEERING 3 UNITS

Word processing principles of operation, applications and exercises; Spreadsheet principles, applications, demonstration and hands-on exercises; Database management principles and operations, applications and demonstrations; hands on exercises in use of a popular report presentation package, such as PowerPoint; mini-project to test proficiency in the use of software packages.

Types of computer and components, their uses such as industrial, scientific, etc; computer logic, software and hardware; Introduction to computer languages such as Fortran, Basic, Cobol, Mat Lab etc; application of Fortran and Basic to solution of simple problems; Flow Charts; Practical Exercises in the use of computers; further Computer Programming using Q-Basic, Symbols, Keywords, Data types; Visual Programming using Visual Basic for solving engineering problems; filing system directory; file paths & location.

GET 229: ENGINEERING LABORATORY II 2 UNITS

Assigned laboratory exercises to reflect the basic Engineering course in Electrical/Electronics; Engineering Mechanics and Strength of Materials; the Lecturer will provide guidance on specific experiments and calculations.

GET 299: STUDENT WORK EXPERIENCE PROGRAMME (SWEP) I 2 UNITS

Practice and skills in general engineering through instruction in operation of hand and powered tools for wood and metal cutting and fabrication; hand on experience in usage of tools and machine selected tasks.

General practices on automobile repairs, survey, civil, electrical and other related engineering practices.

GSE 311: ENTREPRENEURIAL STUDIES 2 UNITS

Introduction to entrepreneurship and new venture creation. What is entrepreneurship? The role of the entrepreneur in enterprise creation. How are new ventures created? Entrepreneurial finance: Determining your capital requirement; financing strategy; managing cash flow. Introduction to Engineering Entrepreneurship Studies: Engineering ventures to be focused upon include the following: Soap/Detergent, Tooth brushes and Toothpaste making; photography; Brick, nails, screws making; Dyeing/Textile , blocks paste making; Rope making; Plumbing; Vulcanizing; Brewing; Glassware; Paper production; Water; Food processing/packaging/preservation; Metal working/fabrication- Steel and aluminium door and windows; Training industry; Vegetable oil/and salt extraction; Fisheries/Aquaculture: fish and fingerlings production; Refrigeration/Air conditioning; Plastic making; Farming (crop); Domestic Electrical wiring; Radio/TV repairs and Computer; Carving, Weaving; Brick laying/making; Bakery; Tailoring; Welding; Building drawing; Carpentry; Leather tanning; Animal husbandry; Metal Craft.

GET 311: ENGINEERING MATHEMATICS III 3 UNITS

Applied series: expansion of power series, application of Taylor's series, Fourier series, orthogonal system of functions, and the parseva's relation; Hilbert space, orthogonality with weight function, special functions including Gamma. Beta, Error, Bassel, Legendre and hypergeometric functions; introduction to analytic functions, Cauchy-Riemann equations, and conformal mappings.

Operational calculus: Laplace transform, theory and application to initial-value problems; Z-transforms; Fourier transforms; Introduction to partial differential equations: elliptic, hyperbolic and parabolic equations. Applications of Engineering analysis and methods with MATLAB

GET 321: ENGINEERING MATHEMATICS IV 3 UNITS
Probability: motivation; probability models; probability axioms; combinatorial problems; conditional probability; independence of events; Bernoulli trials; discrete and continuous random variables; mass, distribution and generating functions; random vectors; independent random variables; exponential distribution; reliability; failure density; hazard function; some important distributions; functions of two random variables; transform methods; computation of mean time to failure; inequalities and limit theorems; conditional distribution and expectation; stochastic process; Bernoulli, Poisson and renewal process; availability analysis; random incidence; introduction to discrete and continuous Markov chains. Statistics: measures of central tendency; statistical inference; parameter estimation; hypothesis testing; regression; correlation and analysis of variance; elements of experimental design. Applications Engineering analysis and methods with MATLAB.

GET 322: TECHNICAL REPORT WRITING AND SEMINAR 1 UNIT
Data gathering and presentation; technical correspondence such as letters of inquiry and replies, letters of application and memoranda; illustrating technical writing using tables, graphs, diagrams, equations and appendices; writing progress reports, proposals, student projects, thesis and dissertations; oral and visual presentations; computer-aided technical writing and presentation using word processing and presentation software packages.

GET 399: STUDENT WORK EXPERIENCE PROGRAMME (SWEP) II 3 UNITS
On the job experience in Engineering chosen for practical working experience but not necessarily limited to the student's major (during the long vacation following 300 level).

GET 411: ENGINEERING MATHEMATICS V 3 UNITS
Review of the number systems and error analysis; numerical schemes, error analysis, computer algorithms and programs for the solution of problems including interpolation by polynomials, nonlinear equations, systems of linear equations, determinants and matrices, and eigenvalue problems; approximations including data fitting, orthogonal polynomials, least squares, splines and fast Fourier transform; differentiation and integration; difference equation; differential equations by Runge-Kutta and other

methods; boundary value problems in ODE; introduction to the finite-difference method for partial differential equations. Applications of Engineering analysis and methods with MATLAB.

GET 429: STUDENTS INDUSTRIAL WORK EXPERIENCE SCHEME (SIWES) 6 UNITS
Students are required to undertake a six (6) months practical industrial work experience in any relevant industries involving design, construction and testing of mechanical systems.

GET 511: ENGINEERING LAW 2 UNITS
LEGAL DEFINITIONS AND SPECIFICATIONS: Law, ethics and conduct in engineering;
LAW OF CONTRACT: engineering contracts and contract documents, enforceability of contracts.
INDUSTRIAL RELATIONS: employment law and unionism, terms and conditions of employment
INTELLECTUAL PROPERTY: patents, trademarks, copyrights, license and royalty; technology transfer issues;
SAFETY AND ENVIRONMENTAL LAW: health and safety law, environmental guidelines and laws; technology impact assessment: responsibility and liabilities to worker and staff, users and public.
LAW SUITS: court proceedings and Engineer as a witness;

GET 521: ENGINEERING MANAGEMENT 2 UNITS
BASIC CONCEPTS FOR ECONOMIC ASSESSMENT OF ENGINEERING PROJECTS: Accounting methods; marginal analysis; cash flow and time value of money; taxation and depreciation; discounted cash flow analysis techniques; cost of capital; inflation;
SENSITIVITY AND RISK ANALYSIS; replacement decision; analysis of R and D; on-going as well as new investment opportunities;
ENGINEERING AND PUBLIC SECTOR DECISION MAKING; qualitative considerations and multiple criteria. **ENGINEERING BUSINESS:** type, structure, goals and functions of organizations; **MANAGEMENT OF ENGINEER TO MANAGE TRANSITION;** R&D management; project selection and management; advanced manufacturing systems management; capital investment policies; technological collaborations: sub-contracting, consultancies, joint ventures and linkage programmes; management of change and innovation.

CHAPTER TWO

DEPARTMENT OF CHEMICAL ENGINEERING



CHEMICAL ENGINEERING LABORATORY

TITLE OF DEGREE PROGRAMME

This is the degree of Bachelor of Engineering (B.Eng.)

PHILOSOPHY

- o To develop and provide engineering education geared towards the achievement of national goals and objectives of industrialization and self reliance.
- o The provision of training in theory and practice of engineering.
- o Early introduction of students to entrepreneurial education and training.
- o Acquisition of practical industrial experience for students by partnering with local industries in the execution of the students Industrial Work Experience Scheme (SIWES).

OBJECTIVES

- o The mission of the undergraduate program is to educate future leaders in chemical engineering who effectively combine their broad knowledge of the basic sciences with their engineering analysis and design skills for the creative solution of problems in chemical technology for the synthesis of innovative chemical processes and products.
- o Graduates will be successful in their professional careers, as demonstrated by their abilities to solve important chemical engineering problems, to solve problems in areas different from their training, and to develop their new and valuable ideas by their contributions to new or improved products and processes and/or to publications, presentations and patents.
- o Graduates will be able to work in a variety of professional environments, both private and public sectors of the economy, as demonstrated by their abilities to work on

teams, to work alone, to provide leadership, to mentor junior co-workers, and to communicate effectively.

- o Graduate will possess professional character, as demonstrated by their ethical behavior, their pursuit of professional registration, their commitment to lifelong learning, and their commitment to safety and the environment and including the concept of sustainable development, into chemical engineering practice.
- o Graduates will lead or participate successfully on multidisciplinary teams assembled to tackle complex multifaceted problems that may require implementation of both experiment and computational approaches and a broad array of analytical tools

RATIONALE AND OUTCOME

The programme outcomes of the chemical engineering curriculum are as follows:

- o Graduates will understand and be able to analyze entire chemical processes.
- o Graduates will be proficient in the oral and written communication of their work and ideas.
- o Graduates will be proficient in the use of computers, computer software, and computer-based information systems.
- o Graduates will have the ability to learn independently but will also be able to participate effectively in groups.
- o Graduates will be able to design effective laboratory experiments, gather and analyze data, and test theories.
- o Graduates will be prepared for a life time of continuing education
- o Graduates will understand the safety and environmental

consequence of their work as chemical engineers and be able to design safe processes.

- o Graduates will understand their professional and ethical responsibilities.
- o Graduates will have the broad education necessary to understand the impact of engineering solutions global and societal context.

ADMISSION REQUIREMENTS

To be eligible for admission into the degree programme of the Department of Chemical Engineering, all applicants must satisfy the minimum entrance requirements stipulated in the UTME Regulations. That is, all applicants must possess a minimum of five (5) credit passes in their WAEC or NECO ordinary level English, Mathematics, Physics and Chemistry examinations, and any one of the following subject: Further Mathematics, Biology, Agricultural Science and Technical Drawing, Economics, Geography and Fine and Applied Art. In addition, applicants must obtain the minimum cut-off point in UTME and PUTME (or equivalent) for the degree programme in the same cluster of five subjects.

STAFF PROFILE

DEPARTMENT OF CHEMICAL ENGINEERING STAFF LIST

S/N	NAMES	RANK	QUALIFICATION	SPECIALIZATION	STATUS
1	Engr. Prof. C. N. Owabor	Professor	B.Sc. (Biochemistry), PGD, (Chemical Eng.), M.Eng. (Chemical Eng.), Ph.D (Chemical Eng.), MNSChE, MNSE, COREN (R10,827)	Biochemical Engineering, Transport operations in Chemical and Bio-system Engineering	Permanent
2	Engr. Prof. M. F. N Abowei	Professor	HND (Chemical/petroleum Eng.), M.Tech. (Chemical/Petrochemical Eng.), Ph. D (Chemical Eng.), MNSE, COREN (R19,838)	Reaction and Petrochemical Engineering	Sabbatical
3	Engr. Dr. K.M. Oghenejoboh	Assoc. Professor	B. Eng. (Chemical Eng.), M. Eng. (Chemical Eng.), Ph. D (Chemical Eng.), MNSE, COREN (R22640)	Pollution and Pollution Control, Process control, Instrumentation and simulation, Bio-fuel and renewable energy studies	Sabbatical
4	Engr. Dr. I.O. Oboh	Assoc. Professor	B.Engr. (Chem. Eng.), M.Eng. (Chem. Eng.), Ph.D (Chem. Eng.), MNSChE, MNSE, COREN (R)	Reaction and Petrochemical Engineering.	Sabbatical
5	Engr. Dr. A. O. Okewale	Senior Lecturer	B. Tech. (Chemical Eng.), M. Eng. (Chemical Eng.), Ph.D (Chemical Eng.), MNSChE, COREN (R25, 524).	Separation processes, Corrosion Engineering, and Renewable Energy	Permanent
6	Engr. Dr. E. O. Ohimor	Senior Lecturer and Ag. Head of Department	B. Eng., (Chemical Eng.), M. Eng., (Chemical Eng.), Ph.D (Bioprocess and Food Eng.), MNSChE, MNSE, COREN (R21,960).	Biochemical Engineering, Flow Assurance.	Permanent
7	Engr. Dr. O. O. Olayebi	Senior Lecturer	B. Eng. (Chemical Eng.), M. Eng. (Chemical Eng.), MNSE, FNSChE. COREN (R4,573),	Mathematical Applications to process Analysis and Design, Modelling and Simulation, Separation Process.	Permanent

HANDBOOK OF GENERAL INFORMATION FOR UNDERGRADUATE STUDENTS

8	Engr. Dr. Teddy Odisu	Lecturer I	B. Eng. (Chemical Eng.), M. Eng. (Chemical Eng.), Ph.D (Chemical Eng.), MNSChE, MNSE, COREN (R21,411)	Reaction Engineering, Fluid Dynamics, Computer Applications, Flow Assurance	Permanent
9	Ms. Ovonomo Onocha	Lecturer I	B. Eng., (Chemical Eng.), M.Sc., (Chemical Eng.)	Environmental Engineering	Permanent
10	Mr. Felix Omoruwou	Lecturer I	B. Eng., (Chemical Eng.), M. Eng., (Chemical Eng.)	Environmental and Biochemical Engineering	Permanent
11	Engr. (Mrs.) C. E. Anih	Lecturer I	B. Eng., (Chemical Eng.), M. Eng., (Chemical Eng.) MNSE, COREN (R49489)	Biochemical Engineering	Permanent
12	Ms. V. O. Igenegbai	Lecturer II	M. Eng., (Chemical Eng.)	Petrochemical Engineering, Fuel technology, Renewable Energy	Permanent
13	Mr. N. E. Moses	Lecturer II	B. Eng., (Chemical Eng.), M. Eng., (Chemical Eng.)	Biochemical Engineering	Permanent
14	Mr. P. F. Tarbuka	Lecturer II	B. Eng., (Chemical Eng.) M. Eng., (Chemical Eng.)	Chemical Engineering	Permanent
15	Mrs. E. M. Effi	Principial Laboratory Technologis t	HND (1998), MPE, NATE, COREN.	Petrochemical and Gas Processing	Permanent
16	Mrs. F. B. Osundare	Principial Laboratory Technologis t	HND (1998), NATE	Petrochemical and Gas Processing	Permanent
17	Mr. A. T. Adebayo	Senior Laboratory Technologis t I	HND (2011) , NATE	Chemical Engineering	Permanent

FIRST SEMESTER						
COURSE CODE	COURSE TITLE	L	T	P	CREDIT UNIT	STATUS
EEE 211	Basic Electrical Engineering I	2	-	-	2	C
GET 211	Engineering Mathematics I	2	1	-	3	C
GET 212	Engineer -in- Society	2	-	-	2	C
GET 219	Engineering Laboratory I	-	-	6	2	C
MEE 211	Engineering Drawing I	-	-	3	2	C
MEE 212	Engineering Mechanics I	2	-	-	2	C
MEE 213	Basic Manufacturing Technology	2	-	-	2	C
MEE 214	Engineering Materials	2	-	-	2	C
MEE 215	Fluid Mechanics I	2	-	-	2	C
MEE 216	Basic Thermodynamics	2	-	-	2	C
PEE 211	Introduction to Oil and Gas Industry	1	-	-	1	C
TOTAL CREDIT UNITS					22	

SECOND SEMESTER						
COURSE CODE	COURSE TITLE	L	T	P	CREDIT UNIT	STATUS
CHE 221	Introduction to Chemical Engineering	2	1	-	2	C
CHE 222	Chemistry for Engineers	2	-	-	2	C
CVE 221	Basic Civil Engineering	2	-	-	2	C
EEE 221	Basic Electrical Engineering II	2	-	-	2	C
GET 221	Engineering Mathematics II	2	1	-	3	C
EEE 222	Information Technology in Engineering	2	1	-	2	C
GET 229	Engineering Laboratory II	-	-	6	2	C
MEE 221	Engineering Drawing II	-	-	3	2	C
MEE 222	Engineering Mechanics II	2	-	-	2	C
GET 223	Basic Workshop Practice	-	-	3	1	C
MEE 224	Strength of Materials I	2	-	-	2	C
GET 299	Student Work Experience Programme (SWEP) I	-	-	-	2	C
TOTAL CREDIT UNITS					24	

300-LEVEL

FIRST SEMESTER						
COURSE CODE	COURSE TITLE	L	T	P	CREDIT UNIT	STATUS
GSE 311	Entrepreneurial Studies	2	-	-	2	C
CHE 311	Material and Energy Balance Calculations	2	1	-	3	C
CHE 312	Transport Phenomena I	2	1	-	3	C
CHE 313	Chemical Reaction Kinetics I	2	1	-	3	C
CHE 314	Chemical Engineering Lab I	1	-	3	2	C
CHE 315	Petroleum Refining and Petrochemical Processes	2	1	-	3	C
CHE 316	Biochemical Engineering I	2	1	-	3	C
GET 311	Engineering Mathematics III	2	1	-	3	C
MEE 317	Basic Safety Engineering	1	-	-	1	C
TOTAL CREDIT UNITS					23	

SECOND SEMESTER						
COURSE CODE	COURSE TITLE	L	T	P	CREDIT UNIT	STATUS
CHE 321	Separation Processes I	2	1	-	3	C
CHE 322	Polymer Science and Technology I	2	1	-	3	c
CHE 323	Environmental Engineering	2	1	-	3	C
CHE 324	Chemical Engineering laboratory II	1	-	3	2	C
GET 321	Engineering Mathematics IV	2	1	-	3	C
GET 322	Technical Report Writing and Seminar	1	-	-	1	C
GET 399	Student Work Experience Programme (SWEP) II	-	-	-	3	C
TOTAL CREDIT UNITS					18	

400-LEVEL

FIRST SEMESTER						
COURSE CODE	COURSE TITLE	L	T	P	CREDIT UNIT	STATUS
CHE 410	Process Modelling and Simulation	1	-	3	2	C
CHE 411	Separation Processes II	2	1	-	3	C
CHE 412	Process Instrumentation	2	-	-	2	C
CHE 413	Chemical Engineering Plant Design and Economics	2	1	3	3	C
CHE 414	Chemical Engineering Lab III	1	-	3	2	C
CHE 415	Particulate Systems Analysis	2	1	-	3	C
CHE 416	Chemical Engineering Process Analysis	2	-	-	2	C
CHE 417	Chemical Engineering Thermodynamics	2	-	-	2	C
GET 411	Engineering Mathematics V	2	1	-	3	C
TOTAL CREDIT UNITS					22	

SECOND SEMESTER		
COURSE CODE	COURSE TITLE	CREDIT UNIT
GET 429	Student Industrial Work Experience Scheme (SIWES)	6
TOTAL CREDIT UNITS		6

500-LEVEL

FIRST SEMESTER						
COURSE CODE	COURSE TITLE	L	T	P	CREDIT UNIT	STATUS
CHE 511	Process Optimization	2	1	-	3	C
CHE 512	Process Dynamics and Control	2	1	-	3	C
CHE 513	Chemical Process Technology	2	1	-	3	C
CHE 514	Transport Phenomena II	2	1	-	3	C
CHE 515	Chemical Reaction Kinetics II	2	1	-	3	C
GET 511	Engineering Law	2	-	-	2	C
CHE 598	Final Year Project and Seminar	-	-	9	0	C
	OPTIONAL COURSES (ANY ONE)					
CHE 516	Polymer Science and Technology II	2	1	-	3	0
CHE 517	Technology of fossil fuel processing	2	1	-	3	0
CHE 518	Biochemical Engineering II	2	1	-	3	0
TOTAL CREDIT UNITS					20	

SECOND SEMESTER						
COURSE CODE	COURSE TITLE	L	T	P	CREDIT UNIT	STATUS
CHE 521	Loss Prevention in Process industries	2	-	-	2	C
CHE 522	Chemical Engineering Plant Design Project	2	-	6	4	C
CHE 598	Final Year Project and Seminar	-	-	9	6	C
GET 521	Engineering Management	2	-	-	2	C
	OPTIONAL COURSES (ANY ONE)					
CHE 523	Corrosion Engineering	2	1	-	3	0
CHE 524	Natural Gas Engineering	2	1	-	3	0
CHE 525	Fundamentals of Reservoir Engineering	2	1	-	3	0
TOTAL CREDIT UNITS					17	

200 LEVEL**CHE 221: INTRODUCTION TO CHEMICAL ENGINEERING 3 UNITS**

Units and Dimensions, Conversions of units. Curve fittings, least square method. Dimensional analysis. Raoult's law, Henry's law. Measurement and error analysis. The chemical equation stoichiometry. Calculation of Limiting reactants, Excess reactants, Conversion, Yield and Selectivity. Introduction to Chemical Engineering unit operations, ancillary facilities and Process Engineering, Chemical Engineering process flow charts and process symbols, Introduction and development of The Chemical Process Industry, Chemical Process Principles, Chemical properties and Measurements.

CHE211: CHEMISTRY FOR ENGINEERS 2 UNITS

Behaviour and properties of gases. First law of thermodynamics: ideal gas relationships, thermochemistry. Second and third laws of thermodynamics: entropy and entropy changes, free energy functions. Chemical equilibrium for homogenous and heterogeneous systems, shifts of equilibrium, effects of temperature and pressure. Theories of strong and weak electrolytes, molar and ionic conductivities. Activity coefficients and ionic equilibria for dilute solutions. Surface Phenomenon, colloids and Catalysis.

Organic Chemistry; Sulfonation; Nitration; Hydrogenation; Amination; Halogenation, etc.

Principles of chromatography, Electro Chemistry, Redox Methods, Titrimetry, Precipitate Formation.

300 LEVEL**CHE 311: MATERIAL AND ENERGY BALANCE CALCULATIONS 3 UNITS**

Material balances. Program of analysis of material balances. Program of analysis of material balance problems with direct solutions. Material balances using algebraic techniques control surface and stage balance for open and closed system. Material balances involving condensation and vaporization phase phenomena. Energy balances. Concepts and units. Heat capacity. Calculation of enthalpy changes without change phase. Enthalpy changes for phase transition. General energy balance. Reversible process the mechanical energy balance. Heat of reaction. Heat of solution and mixing combining material and energy balances; Application of fundamental concepts of mass and energy balances and mass transfer to unit operations in distillation. Simultaneous use of material and energy balances for the steady state. Energy balances for adiabatic

and non-adiabatic process. Unsteady state material and energy balances.

CHE 312: TRANSPORT PHENOMENA I 3 UNITS

Basic Laws of mass, momentum and energy transfer process and their relationships; Prediction of transport coefficients, simple problems involving dimensionless groups such as Re, Sc, Pr, Boundary layer theory and turbulence; Navier stokes equation; Universal velocity profile, Eddy diffusion; Theories of Mass transfer; Mass transfer with chemical reaction; Interfacial mass transfer; Fluid flow; Flow in pipes and nozzles, open channels, Flow measurement devices; Pumps, Compressors, Valves and Piping; Fick's law.

CHE 313: CHEMICAL REACTION KINETICS I 3 UNITS

Basic terminology used in chemical engineering reaction kinetics; General principles of experimental techniques; Interpretation of kinetic data; Homogenous reaction, Heterogeneous reactions; Chain reaction simultaneous and consecutive reactions; Photochemical reactions; Catalysis, Absorption of gases on solids; application of gas chromatography. Classification and types of reactions. The rate equation; Methods of operation and design equations for Batch and Flow (CSTR and PFR) reactors; single and multiple reactions. Temperature and pressure effects.

CHE 314: CHEMICAL ENGINEERING LABORATORY I 2 UNITS

Laboratory experiments designed to teach basic and advanced laboratory techniques and practices in chemical engineering, Errors in measurements of experimental results. Selected experiments in heat transfer, mass transfer, simultaneous heat and mass transfer, chemical reaction engineering, biochemical engineering, process dynamics and control

**CHE 315: PETROLEUM REFINING AND PETROCHEMICAL PROCESSES
3 UNITS**

Introduction; origin; formation and composition of petroleum. Introduction to Petroleum Refining Processes. Refinery products; properties; significant tests and standard test methods; characterization and evaluation of crude oil stocks; generation of crude processing data; crude pre heating and preliminary treatment; pipestill heaters; desalting; chemical treatment of refinery distillation; atmospheric and vacuum distillation; steam stripping; various arrangements of distillation towers. Number of trays calculation by various methods; various types of reflux employed; processing plans, schemes and product patterns of refineries. Modern separation,

CHE 322: POLYMER SCIENCE AND TECHNOLOGY I

Introduction to polymer and their characteristics source of monomers, structure and physical properties of polymers; Solubility and molecular weights; plasticity and elasticity. The William Landel Ferry equation

CHE 323: ENVIRONMENTAL ENGINEERING 3 UNITS

Pollution and the environment definitions and inter-relationship; Natural and manmade pollution, the economics of pollution. Air pollution; Gaseous and particulate pollutants and their sources; effects on weather vegetation material and human health. Legislation relating to air pollution, methods of control of gaseous emission and destruction; cyclones inertia separators electrostatic precipitator bag filters. Wet washers etc., Dispersal from chimney sand methods of calculating chimney height; Flare stacks, water pollution; river pollution by industrial effluent, Legislation and standards for effluent discharge; Impurities in natural water and their effects, Brief survey of ecology and the effects of effluents in the ecosystems; Treatment processes including precipitation flocculation, coagulation, sedimentation, clarification, and colour removal. Principles of biological treatment processes; cost of treatment; treatment for water re-use, ion exchange cooling water treatment. Land pollution; Disposal of solid wastes by incinerator and dumping, Possible future trends including conversion of solid wastes into useful material or energy. Treatment of other types of pollution; noise; Thermal and nuclear pollution.

CHE 324: CHEMICAL ENGINEERING LABORATORY II 2 UNITS

Laboratory experiments in Kinetics and further experiment in Kinetics and further experiment thermodynamics and separation processes.

400 LEVEL**CHE 410: PROCESS MODELING AND SIMULATION 2 UNITS**

Review of programming languages in Fortran, Q-basic, C Programming languages. Solutions of Chemical Engineering problems by Digital computers. Software Applications relevant to Chemical Engineering such as Aspen HYSYS; CHEMCAD; MATLAB; PIPSIM, ETC

CHE 411: SEPARATION PROCESSES II 3 UNITS

Distillation of multi-component mixtures; Extractive and azeotropic distillation; Solvent extraction; Multicomponent gas absorption; Leaching and extraction with immiscible solvents; Novel separation Process.; Ion exchange and reverse osmosis; Humidification and Water cooling.

CHE 412: PROCESS INSTRUMENTATION 2 UNITS

Basic elements of process control: The process sensors, final control elements, the controller. Instrumentation Basics: Sensors, transducers instrumentation signals, transmitters, instrumentation dynamics, instrumentation noise. Process measurements and instruments: Temperature measurement, pressure measurement, flow measurement, valves and pumps. Process characteristics: First order process, higher order processes, process type.

CHE 413: CHEMICAL ENGINEERING PLANT DESIGN AND ECONOMICS 3UNITS

Process design principles, sources of design data; Chemical Engineering design of mass and heat transfer Equipment (plate columns, absorption towers, distillation columns, heat exchangers, vessels, storage tanks etc.) Process services.

Piping and instrumentation, Costing and project evaluation. Presentation and discussion of real process design problems; process and engineering flow diagram; process outline charts incorporating method study and critical examination; mechanical design of process vessels and piping. Environmental consideration; Site considerations; Costing of design process. Economics and safety considerations.

CHE 414: CHEMICAL ENGINEERING LABORATORY III 2 UNITS

Laboratory experiments in process instrumentation heat transfer and further experiments in separation process. Laboratory experiments in separation processes, transport phenomena, thermodynamics and particulate mechanics.

CHE 415: PARTICULATE SYSTEMS ANALYSIS 3 UNITS

Particle -Fluid mechanics; Motion of single particles and drops in fluids; Terminal falling velocities; Thickener calculations; Centrifuging characteristics of a rotating fluid. Principles of separation by sedimentation, flocculation, filtration and centrifuging. Types of centrifuges. Flow of single fluid through packed beds; Calculation of pressure drop, Counter-current and co-current flow of fluids through packed columns; Flooding and loading rates. Fluidization; Types of fluidization, calculation of minimum fluidization velocities. Factors influencing fluidization

characteristics; Behavior of bubbles, Heat and mass transfer and chemical reaction in fluidized beds. Conveying principles of pneumatic and hydraulic conveyance; Flow of non-newtonian suspensions. Size reduction. Law of comminution. Particle size distribution and size analysis; selection of equipment; Atomization of liquids, size enlargement. Mixing of fluids and solids; power requirements and selection of equipment.

CHE 416: CHEMICAL ENGINEERING PROCESS ANALYSIS 2UNITS

Formulation of models for chemical engineering reacting and non-reacting systems and their numerical solutions. Design of experiments. Gauss Elimination, Newton Raphson, Secant method, Newton's methods. Numerical methods for solving ordinary differential equations (Euler methods) Regression analysis: Curve fitting, least squares; Estimation of uncertainty in regression parameters, multiple linear regression, nonlinear regression. Statistics: Types of observation, analysis of variance. Test of significance.

CHE 417: CHEMICAL ENGINEERING THERMODYNAMICS 2 UNITS

Phase Equilibria; Criteria of equilibrium; Fugacity of pure component; General Fugacity relations for gases; Fugacity of gas mixtures, Effects of temperature and pressure on fugacity, Pressure temperature composition relationship; Phase behavior at low and elevated pressure, Raoult's law, Henry's law, Equilibrium constant; Activity coefficient; Gibbs-Duhem equation; Margules and Van Leer equations. Chemical reaction Equilibria; Standard free energy change and equilibrium constant. Evaluation of equilibrium constants. Effects of temperature and pressure on equilibrium constants; Calculation of conversion; Gas phase reactions, Percent conversion; Liquid coefficient; Gibbs-Duhem equation; Margules and Van Leer equations. Chemical reaction Equilibria; Standard free energy change and equilibrium constant. Evaluation of equilibrium constants. Effects of temperature and pressure on equilibrium constants; Calculation of conversion; Gas phase reactions, Percent conversion; Liquid phase reaction. Heterogeneous reactions. 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 of reaction. Heats of mixing and solution, Enthalpy concentration diagrams, Partial enthalpies, Thermodynamics of flow processes. Fundamental equations, continuity equation; equation of motion; energy equation; Bernoulli's equations.

500 LEVEL**CHE 511: PROCESS OPTIMIZATION 3 UNITS**

Stationary optimization-Differential approach, Numerical approach, Linear and non-linear programming, Trajectory optimization single and multivariable feat techniques; constrained optimization techniques; Discreet events; Network analysis and queuing theory.

CHE 512 PROCESS DYNAMICS AND CONTROL 3 UNIT

Introduction to process dynamics and control; Review of mathematical tools needed for modeling and simulation, process dynamics, review of laplace transforms; transient behavior of 1st, 2nd and higher order systems; Process control, Basic components of the process control system and their characteristics, closed loop transient response, stability analysis/frequency response analysis; Design of feedback controllers based on frequency response criteria; Design of model based controllers such as IMC, DMC etc.

CHE 513: CHEMICAL PROCESS TECHNOLOGY 3 UNITS

Overview of the chemical industry with examples cited. Industrial Water Supply and Waste-Water Treatment: Sources of water, test on water and wastewater. Clarification, softening, de-ionization and desalination. Treatment of water/wastewater. Industrial inorganic chemicals. Raw materials, technical and economic principles of processes and routes to products. Flow diagrams, selection from sulphuric acid, phosphoric acid, ammonia, nitric acid and fertilizers, salt, chlorine and sodium hydroxide; aluminum, iron and steel; tin, cement and glass. Hydrogen and carbon monoxide: synthesis gas oxo process, water gas, sources of hydrogen and its possible future uses.

Industrial Organic Chemicals: Raw materials, technical and economic principles of processes and routes to product. Flow diagrams. Sugar technology, paints and varnishes; plastics.

Evaluation of Process: Basic considerations, economic feasibility, technical feasibility and other considerations. Chemical patents and trademarks: legal requirements, patent structure and language, etc. Research and Development (R & D): Function of R & D, process improvement; process development, etc.

CHE 514: TRANSPORT PHENOMENA II 3 UNITS

Nature of processes of conduction, convection and radiation; definition of thermal conductivity and heat transfer coefficients. Conduction through materials with constant and varying heat transfer areas; unsteady state conduction solution of equations for simple cases' Schmidt's methods. Principles of free and forced convection, determination of film transfer coefficient, Radiation; Kirchoff's and Stefans law, Emissivity, calculation of net heat exchange between bodies; multiple reflection and radiation methods. Radiation from gases. Heat transfer to boiling liquids; types of boiling and influence of conditions on heat fluxes and transfer coefficients. Heat exchanger design.

CHE 515: CHEMICAL REACTION KINETICS II 3 UNITS

Fluid mixing and residence time distribution; Fluidized bed, trickle bed and slurry reactors. Factors affecting choice of reactors; Reactor design calculations under isothermal and non – isothermal conditions; Characterization of catalysts; Rate controlling regimes in gas solid reactions catalyzed by porous catalyst effectiveness factor scale up procedure catalyzed by porous catalyst effectiveness factor scale up procedure catalyst decay and reactivation.

CHE 516: POLYMER SCIENCE AND TECHNOLOGY II 3 UNITS

Introduction to polymer and their characteristics source of monomers, structure and physical properties of polymers; 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 517: TECHNOLOGY OF FOSSIL FUEL PROCESSING 3 UNITS

Source, availability and characterization of fossil fuel (Petroleum, Natural gas, tar sands, coal). Modern processing technology: Choice of product lines and products: Alternative product lines and products specification to be emphasized.

CHE 518: BIOCHEMICAL ENGINEERING II 3 UNITS

FERMENTATION TECHNOLOGY introduction. Evolution of modern fermentation processes; Requirements for the growth of microorganisms. Media formulation; Alteration and consequences of environment in fermentations; parameters and control

of fermentation processes; sterilization of media air and equipment; control of pressure,, temperature, pH, redox potential; Use of antifoam agents. Nature of fermentation fluids; product recover; Batch and continuous fermentations; Instrumental control of Fermenters; Examples of industrial fermentations to produce chemicals, food and related substances.

CHE 521: LOSS PREVENTION IN PROCESS INDUSTRIES 2 UNITS

Hazards in chemical process industries, safety in plants, causes of accidents in process plants, prevention of accidents. HAZOP techniques. Maintenance of plants to minimize losses, waste disposal and effluent treatment, pollution control, legal implications of various losses. Introduction; safe work practices; personal protective equipment and costumes; electrical safety; mechanical hazards; chemical hazards; environmental hazards; safety in hazardous area; industrial safety and analysis; fire prevention and fire fighting systems; building design and fire protection; first aid.

CHE 522: CHEMICAL ENGINEERING PLANT DESIGN PROJECT 4 UNITS

Students are divided into groups. Each group is assigned a chemical engineering design problem involving the study of a process. Each group is allowed two months to complete the design project. The project will involve the choice and preparation of process flow sheet, calculation of material and energy balances, equipment selection and specification, detailed design of some plant items, plant layout and instrumentation, economic analysis and safety considerations.

CHE 523: CORROSION ENGINEERING 3 UNITS

Introduction to various forms of corrosion: direct corrosion, electrochemical corrosion, liquid metal corrosion types: oxidation, oxide firms, scale formation. Internal oxidation corrosion and electrode potential, corrosion rates. Combating corrosion. Protective coating, cathodic and anodic protection. Proper design and selection of materials.

CHE 524: NATURAL GAS ENGINEERING 3 UNITS

Composition of Natural Gas. The Natural Gas Industry. Application of the concept of thermodynamics, transfer phenomena and phase behaviour in the conditioning and processing of natural gas and its liquids, adsorption, absorption and fractionation processing. LPG, LNG system. Design of natural gas facilities-pressure losses in pipes. Pressure losses in armature and fittings. Pumps. Nozzle theory and mass transfer. Dehydration; Need for dehydration of gas; Dew point depression; Absorption with

glycol and adsorption with solids; Sulphur removal; Scale problems. Control of gas quality. Adsorption facilities. Fractionation and heat exchanger design. Gas Storage. Wellhead Equipment and gathering systems. Flow of Natural Gas: Field Compression. **Static and Flowing bottom hole pressures calculations.** Gas hydrates, hydrogen sulphide. Gas flow measurement: orifice meter, critical flow prover; Absolute open flow potential. **Gas Transportation in Offshore Environment.**

CHE 525: FUNDAMENTALS OF RESERVOIR ENGINEERING 3 UNITS

Activities in Reservoir Engineering. Technical responsibilities of the Reservoir Engineer. Principles of reservoir engineering. **Basic Reservoir data, rocks and fluid properties (PVT, porosity, permeability, specific surface of rocks, compressibility of rocks and fluids, etc.). Applications of reservoir fluids characteristics, material balance equations, specific types, Application to gas and condensate reservoirs; general drive mechanisms in reservoir systems.** Calculation of Stock Tank Oil Initially in Place (STOIIP). Feed Unitisation and equity determination of Oil Initially in Place (OIIP). Recoverable resources. Moveable oil. Calculation of Gas Initially in place (GIIP). **Material balance analyses of reservoir drives; Secondary recovery by water/gas injection. Water influx theory. Natural Gas Wells. Deliverability of gas reserves; Material balance, Pressure decline curve.** Field Development planning and execution.

CHE 598: FINAL YEAR PROJECT AND SEMINAR 6 UNITS

Student's individual final year research project under the supervision of an academic staff. The project should be on industrial problems that are significant to the national economy and may be design problems involving the study of processes. It should consist of preparation of flow sheet and heat and mass balances of the process and a detailed design of plant or unit operating equipment used in the process. Due consideration must be given to safety. Each student is expected to submit and orally defend a bound copy of technological/engineering design project. A design project should consist of introduction, literature review, process design, detailed design of some of the units of the process, specification of the equipment required, specification of materials of construction, basic mechanical design and drawings, inclusion of process control, modern drawings of the process equipment including a good flow chart, economic and environmental considerations.

CHAPTER THREE

DEPARTMENT OF CIVIL ENGINEERING



CHEMICAL ENGINEERING LABORATORY

TITLE OF DEGREE PROGRAMME

This is the degree Bachelors of Engineering (B. Eng.)

INTRODUCTION

Civil Engineering is a major field of engineering for national development. Almost every infrastructure and major facilities in a nation or industry has significant contributions from the field of civil engineering. The development of these infrastructure may not be achieved at economic cost or may not stand the test of time without input from civil engineering. Their functions ranges from developing surveyed layouts for such facilities, obtaining structural designs, to erecting the structure itself. Sustainable state-of-the-art bridges, railway lines, water channels, sky scrapers and many more facilities, are some feats of civil engineering. The advancement of technology has led to a the improvements in society.

While the Federal University of Petroleum Resources is a specialized university that caters to the needs of the Oil and Gas industry, the Department of Civil Engineering offers a broader range of expertise. New students coming into the programme are first put through a rigorous training in mathematics and the core science subjects to ensure a proper foundation for engineering. Secondly, students are exposed to foundation courses in the different fields of engineering to give them a general understanding of engineering. The students are then introduced to the core Civil Engineering courses in the third year. In the fourth year, students gain practical industrial experience by partnering with local industries in the execution of the Students Industrial Work Experience Scheme (SIWES). In their fifth and final year, students in the program are offered four options, namely;

- Environmental and Water Engineering
- Structural and Materials Engineering
- Survey and Geoinformatics
- Highway and Transport Engineering

Students can specialize in any option by taking some of the elective courses in that option. Upon completion of the programme, students are qualified to pursue lucrative careers in many industries, such as the oil and gas, transportation, water, production and environmental industry.

PHILOSOPHY

- Development and provision of special engineering education geared towards the achievement of national goals and objectives of industrialization and self reliance.
- Provision of training in the theory and practice of engineering.
- Early introduction of students to entrepreneurial education and training.
- Acquisition of practical industrial experience for students by partnering with local industries in the execution of the Students Industrial Work Experience Scheme (SIWES).

VISION

To be ranked Number One amongst all civil engineering departments in Africa and to be a leading pioneer of groundbreaking research and cutting-edge technology in the field of civil engineering.

MISSION

To produce research-oriented, technically-sound graduates that are well equipped to be outstanding professional leaders of excellence in Africa and in the global world.

AIM/OBJECTIVES

The Department of Civil Engineering at the Federal University of Petroleum Resources has the following objectives:

- To produce top-tier graduates who are professionally competent to work in both the private sector and the public sector of the economy.
- To produce graduates capable of initiating and carrying out engineering design and studies
- To produce graduates equipped to participate in the management of industrial production operations
- To produce graduates that are strongly inclined towards research and development activities

ADMISSION REQUIREMENTS

To be eligible for admission into the degree programmes of the Department of Civil Engineering, all applicants must satisfy the minimum entrance requirements stipulated in the UTME Regulations. That is, all applicants must possess a minimum of Five (5) credit passes in either WAEC or NECO ordinary level English, Mathematics, Physics and Chemistry examinations, and any one of the following subject: Further Mathematics, Biology, Agricultural science and Technical Drawing, Economics, Geography and Fine and Applied Art. In addition, applicants must obtain the minimum cut-off points in UTME and PUTME (or equivalent) for the degree programme in the same cluster of five subjects.

COURSES CONTENTS FOR 300 -500 LEVEL PROGRAMMES

COURSE STRUCTURE

300 LEVEL

FIRST SEMESTER						
Course Code	Course Title	L	T	P	Course Credits Units	Status
CVE 311	Fluid Mechanics	3	0	0	3	C
CVE 312	Strength of Materials	3	0	0	2	C
CVE 313	Engineering Geology	3	0	0	2	C
CVE 314	Civil Engineering Materials	3	0	0	3	C

CVE 315	Structural Mechanics I	3	0	0	3	C
CVE 316	Civil Engineering Drawing	2	0	0	2	C
GET 311	Engineering Mathematics III	2	1	0	3	C
CVE317	Civil Engineering Laboratory I	-	-	2	2	C
MEE 317	Basic Safety Engineering	1	0	0	1	C
Total Units					21	

SECOND SEMESTER						
Total Units (First & Second Semester)						
Course Code	Course Title	L	T	P	42 Course Credits Units	Status
CVE 321	Elements of Architecture	2	0	0	2	C
CVE 322	Soil Mechanics I	3	0	0	3	C
CVE 323	Engineering Surveying & Photogrammetry I	3	0	0	3	C
CVE 324	Design of Structures I	3	0	0	3	C
GET 321	Engineering Mathematics IV	3	0	0	3	C
GET 322	Technical Report Writing and Seminar	1	0	0	1	C
CVE325	Civil Engineering Laboratory II	0	0	2	2	C
PEE323	Introduction to Oil and Gas Operations	1	0	0	1	C
GET 399	Students Industrial Work Experience Scheme (SIWES) II	0	0	0	3	C
Total Units					21	
Total Units (First & Second Semester)					42	

400 LEVEL

FIRST SEMESTER						
Course Code	Course Title	L	T	P	Course Credits Units	Status
CVE 411	Hydraulics and Hydrology	3	0	0	3	C
CVE 412	Civil Engineering Practice	3	0	0	3	C
CVE 413	Structural Mechanics I	3	0	0	3	C
CVE 414	Design of Structures II	3	0	0	3	C
CVE 415	Soil Mechanics II	3	0	0	3	C
CVE 416	Engineering Surveying & Photogrammetry II	3	0	0	3	C
CVE 417	Highway Engineering	3	0	0	3	C

CVE 418	Civil Engineering Laboratory III	0	0	2	2	C
	Total Units				23	

SECOND SEMESTER						
GET 429	Students Industrial Work Experience Scheme (SIWES) II	0	0	6	6	C
Total Units (First & Second Semesters)					29	

500 LEVEL

FIRST SEMESTER						
Course Code	Course Title	L	T	P	Course Credits Units	Status
GET 511	Engineering Law	2	0	0	2	C
CVE 511	Structural Mechanics II	2	0	0	2	C
CVE 512	Design of Structures III	2	0	0	2	C
CVE 513	Geotechnical Engineering	3	0	0	3	C
CVE 514	Water Resources & Environmental Engineering	3	0	0	3	C

CVE 514	Water Resources & Environmental Engineering	3	0	0	3	C
CVE 515	Highway & Transportation Engineering	3	0	0	3	C
CVE 516	Foundation Engineering	3	0	0	3	C
PEE 516	Offshore Drilling & Production Operations	2	0	0	2	C
	TOTAL				20	

SECOND SEMESTER						
Course Code	Course Title	L	T	P	Course Credits Units	Status
CVE 521	Terotechnology	2	0	0	2	C
CVE 522	Construction Engineering	3	0	0	3	C
CVE 523	Building Services Engineering	3	0	0	3	C
CVE 524	Hydraulics Design	3	0	0	3	C
CVE 525	Waste Management Engineering	3	0	0	3	C
GET 521	Engineering Management	2	0	0	2	C
CVE 599	Project	6	0	0	6	C
	TOTAL				23	
Total Units (First & Second Semester)					43	

COURSE DESCRIPTION

300 LEVEL

CVE 311: Fluid Mechanics

3 UNITS

Fluid statics: Floatation and Stability. Dynamics of fluid flow - conservation equation of mass and momentum. Enter and Bernoulli equations. Introduction to incompressible viscous flow. Reynold's number. Dimensional analysis - Philosophy. Similitude. Buckingham P1 theorems. Applications. Hydraulic models. Flow measurements. Flow meters, errors in measurement.

CVE312: Strength of Structural Materials

3Units

Advanced topics in Bending moment and shear force in beams. Theory of bending of beams. Deflection of beams. Unsymmetrical bending and shear centre. Applications. Strain energy. Biaxial

CVE312: Strength of Structural Materials **3Units**
Advanced topics in Bending moment and shear force in beams. Theory of bending of beams. Deflection of beams. Unsymmetrical bending and shear centre. Applications. Strain energy. Biaxial

CVE 313: Engineering Geology **3 Units**
Geology structures and mapping. Rocks and minerals. Stratigraphy - time scale - fossils and their importance: special reference to Nigeria. Introduction to geology of Nigeria. Engineering Applications - Water supply, site investigation - Dams, Dykes, etc.

CVE 314: Civil Engineering Materials **3 Units**
Concrete Technology - types of cements, aggregates - properties. Concrete mix, Design, Properties and their determination. Steel Technology - Production fabrication and properties: corrosion and its prevention. Tests on steel and quality control. Timber Technology - Types of wood, properties, defects, stress grading. Preservation and fire protection, timber products, Rubber, plastics: Asphalt, tar, glass, lime, bricks, etc. Applications to buildings, Roads and Bridges.

CVE 315: Structural Mechanics I **3 Units**
Analysis of determinate structures. Beams, Trusses: structure theorems, Graphical methods: Application to simple determinate trusses. Williot Mohr-diagram. Deflection of statically determinate structures. Unit load, moment area methods. Strain

Energy Methods. Introduction to statically indeterminate structures.

CVE 316: Civil Engineering Drawing **2 Units**
Symbols and conventions. Dimensions, notes, titles, working or construction drawing and relationship to specifications. Plans, Floors, Foundation, Framing and Roof plans. Sections and Details,

wall section, building section and sectional elevations. Drawing and detailing of Civil Engineering structure e.g. bridges, dams, foundations, etc..

CVE317: Civil Engineering Laboratory I **2 UNITS**

- (i) Demonstration of Plumbing, Painting, Ceramic production, Water treatment and packaging, Brick making and Laying.
- (ii) Field trip (Mid- session): Soil/Rock identification in the field, geological structures.

MEE 317: Basic Safety Engineering **1 UNIT**

Principles of general safety and safety education; home safety, safe working practices; electrical safety; mechanical hazards; chemical hazards; environmental hazards; safety in hazardous area; industrial safety and analysis; fire safety, personal protection and fire arm safety; Road traffic and pedestrian safety; Occupational safety; Natural and man-made disasters; Health assurance.

CVE 321: Elements Of Architecture **2 UNITS**

Introduction-Dimensional awareness, Graphical communication, relation to environments. Free hand drawing - form in terms of shades, light shadow. Common Curves. Orthographics; dimetrics, perspective projections. Applications. Elementary Designs.

CVE 322: Soil Mechanics I **3 UNITS**

Formation of soils, soil in water relationship - void ratio, porosity, specific gravity and other factors. Soil classification. Atterberg limits - particle size distribution. Flow in soils - see page and permeability. Laboratory work.

CVE 323: Engineering Surveying and Photogrammetry I **3 UNITS**

Chain Surveying Compass surveying - Methods: Contours and their uses. Traversing - methods and applications. Leveling - Geodetic leveling - errors and their adjustments. Applications. Tachometry - Methods: Substance heighting. Self-adjusting and

electromagnetic methods. Introduction to Photogrammetry.

CVE 324: Design of Structures I **3 UNITS**
Fundamentals of design process, materials selection, building regulations and codes of practice. Design philosophy, elastic design: limit state design. Design of structural elements in Reinforced concrete.

CVE325: Civil Engineering Laboratory I I **2 UNITS**

- (i) Collecting and preserving soil samples from site, Use of hand auger, Moisture content determination, Sieve analysis, Hydrometer analysis, Specific gravity test,
- (ii) Atterbergs limits, USCS & AASHTO Classification Systems.
- (iii) Concrete Mixing, Compacting factor test, slump test, Compacting factor test, Vebe consistometer, Setting time test, Aggregate abrasion value test. Compression test, Curing of concrete cubes.
- (iv) Practicals in surveying ,Compass traverse, running lines of levels, sectioning and Theodolite takes. Identification of features in air photographs, viewing of photographs with pockets and mirror stereoscopes plotting of site plans by bearings and distance and from coordinates by use of AutoCAD and MICROSTATION SE Software.
- (v) Rock/mineral identification; geological map-section tracing and interpretation/examination of thin sections of the major rocks(granite, gneiss, schist, marble, etc.) in petrographic microscope for appreciation of the fabric of the rocks.

PEE 323: Introduction to Oil And Gas Operations **1 UNIT**
Overview of the petroleum industry: its history, technical achievements, role in the global economy and future prospects (Global distribution of oil and gas reserves, Distribution of Energy and Hydrocarbons in Nigeria); A brief introduction to modern exploration, production and processing operations as well as highlights of the petroleum industry in Nigeria and the Gulf Guinea.

400 LEVEL

CVE 411: Hydraulics and Hydrology **3 UNITS**
Laminar and turbulent Flows. Boundary layer separation lift and Drag. Stream function Velocity potential and application to flow nets. Steady and Unsteady flow in closed conduits. Principles of surface water hydrology. Analysis of hydrographic data. Land Drainage and inland navigation problems.

CVE 412: Civil Engineering Practice **3 UNITS**
Civil Engineering Works standard and measurements. Contracts and sub-contracts. Works construction and supervision. Job planning and control - Programme charts - Bar charts. Critical path methods, etc.. Construction machinery and equipment. Applications/Case study-dams, foundations, bridges, highways, industrial buildings, sewage works.

CVE 413: Structural Mechanics II **3 UNITS**
Indeterminate structural analysis. Energy and Virtual work methods, slope deflection and moment distribution methods. Elastic Instability. Simple plastic theory of bending. Collapse loads. Stress-Grading of Timber. Visual mechanical and electronic stress grading of timber.

CVE 414: Design of Structures II **3 UNITS**
Limit state philosophy and design in steel: elastic and plastic moment Designs. Design of structural elements in steel and connections and joints. Limit state philosophy and design in timber. Elastic methods and design in timber. Design of structural elements in timber and timber connectors. Laboratory tests on structural elements in concrete, timber and steel.

CVE 415: Soil Mechanics II **3 UNITS**
Mineralogy of soils, Soil structures. Compaction and soil stabilization. Site investigations. Laboratory and course work.

CVE 416: Engineering Surveying & Photogrammetry II **3 UNITS**

Further work on contours and contouring. Methods of contouring, contour interpolation and uses of contour plants and maps. Areas and volumes. Setting out of Engineering works. Elementary topographical surveying: Elements of Photogrammetry. Photogrammetric equipment and errors of measurements.

CVE 417: Highway Engineering **3 UNITS**

Soil engineering aspects of highways. Railways and airfields. Highway geometrics. Payment structure and design. Pavement materials and Laboratory tests. temperature, and other parameters. Material and energy balance technique - the control surface concept. Introduction to Petroleum Engineering Literature.

CVE 418: Civil Engineering Laboratory III **2 UNITS**

- (i) Compaction test, consolidation test, Triaxial compression test, permeability (Constant and Falling Head) tests,
- (ii) Practical Work Includes: More detailed theodolite traversing and minor triangulations, setting out of works: longitudinal and cross - section profiling: concept of parallax - use of parallax bar for height measurements; setting out of horizontal curves and building curves: plotting from aerial photographs and heighting and contouring GIS applications to a particular project. Setting Out and monitoring of Engineering Works Techniques for various works, baselines, sewers and drains Highways - horizontal curves, vertical and transition curves.
- (iii) Determination of colour, taste, odour and pH of water, Determination of total Alkalinity, total hardness, calcium hardness and CO₂ in water, Determination of conductivity, total solids, dissolved and suspended solids, Determination of iron and magnesium in water, Determination of sulphate and chloride concentrations in water
- (iv) Determination of reynold numbers at different flow rates in laminar/inrbalent flow phenomena, To determine unready flow in surge chambers, To conduct model studies in a wind

tunnel,

(iv) Use of cone penetrometer(CPT), drilling rig and Universal testing machine

500 LEVEL

CVE 511: Structural Mechanics

2 UNITS

Plastic methods of structural analysis, matrix methods of structural analysis, elastic instability: continuum of plane strain, elastic flat plates and torsion, solution by series, finite difference, finite element: yield line Analysis and Strip methods for slabs.

CVE 512: Design of Structures

2 UNITS

Composite design and construction in steel and reinforced concrete; design of structural foundations: pre-stressed concrete design: modern structural form: tall buildings lift shafts and shear walls, system buildings: design projects.

CVE 513: Geotechnical Engineering

3 UNITS

Stressed in soils. Consolidation and settlement. Shear strength of soils. Barths pressures. Bearing capacity of soils. Foundations: normal and deep foundations. Slope stability. Site investigations.

CVE 514: Water Resources and Environmental Engineering 3 UNITS

Water Resources: the hydraulics of open channels and wells: drainage: hydrograph analysis: reservoir and flood-routing: hydrological forecasting: hydraulic structures, i.e. dams, dykes/levees, weirs, docks and harbours, spillways, silting basins, man holes and coastal hydraulic structures, etc.: engineering economy in water resources planning.

Environment Engineering: the work of the Sanitary Engineer: water supply, treatment and design; waste water collection; treatment; disposal and design; solid waste collection, treatment, disposal and design of systems, air pollution and control.

CVE 515: Highway and Transportation Engineering 3 UNITS

Highway planning and traffic surveys. Pavement design, construction and maintenance. Administration and finance of highways. Condition of all transportation media. Transportation planning and economics. Traffic management and design of traffic signals. Parking. Geometrics design. Construction methods. Construction materials and laboratory tests.

CVE 516: Foundation Engineering II 3 UNITS

Site investigations; Field and laboratory measurements. Engineering property of 'soils' for design. Plastic Equilibrium Theory. Design of footings and rate; differential settlement, earth structures excavation, shallow and deep foundations, single piles, group action, coffer dams, bracing and strutting techniques. In-situ testing.

PEE 516: Offshore Drilling & Production Operations 2 UNIT

Offshore drilling; offshore prospecting, offshore rigs. Stationary and floating rigs; rig movement and stability. Drilling from a floating vessel. Subsea BOP stack; marine risers, subsea well head. Offshore Production: Subsea well completion methods, offshore processing equipment and design; loading systems and other transportation. Introductory treatment of Flow Assurance issues in deep waters operations. Offshore Operations: Logistics, Contingency planning; Oil spill and removal.

CVE 521 Terotechnology 2 UNITS

Salvaging of structures, repairs, maintenance and demolition. Evaluation of building performance.

CVE 522: Construction Engineering 3 UNITS

Construction practices and professional relations. Earth-works, equipment, capital outlay and operating cost; Form-work design, component assembly, improvement of productivity and construction practices, safety, project financing, insurance and bonding, contract terms. Solutions to job site and engineering problems in buildings and heavy construction in Nigeria.

CVE 523: Building Services Engineering **3 UNITS**

Engineering study of the materials and equipment used in mechanical and electrical services of buildings. Design of building services components; modern building operation; selection of necessary equipment. Specific topics like illumination of building, comfort, heat loss and heat gain, air conditioning and climate control, water supply and fire protection. Drainage systems, plumbing and sewage disposal, elevators, escalators, building acoustics

CVE 524: Hydraulics Design **3 UNITS**

Design of large scale hydraulic structures: dams, spillways, Stilling Basins. Design of culverts and channel transitions. Reservoir Design Studies. Design of irrigation projects

CVE 525: Waste Management Engineering **3 UNITS**

Quantity and quality of sewage, including important parameters for the determination of quantity and qualities. Sewage system planning, design, construction and maintenance. Sewage treatment processes, including various unit operations. Non-conventional sewage treatment processes including sewage farming, waste stabilization ponds, aerated lagoons and oxidation ditch. Sewage disposal methods including water-dependent and water-independent methods. Water pollution control, solid waste quantity and quality determination, collection, transportation and disposal methods. Institutional

arrangements for management. Management of toxic and hazardous waste.

CVE 599: Projects

6 UNITS

For proper guidance of the students, projects will depend on the available academic staff expertise and interest but the projects should be preferably of investigatory nature. Preferably, students should be advised to choose projects in the same area as their option subjects.

CHAPTER FOUR

DEPARTMENT OF COMPUTER ENGINEERING



COMPUTER ENGINEERING LABORATORY

TITLE OF DEGREE PROGRAMME

This is the degree of Bachelors of Engineering (B.Eng.)

PHILOSOPHY

The philosophy of the programme is to produce competent Computer Engineers needed to meet the manpower requirements in the global industrial sector.

VISION

To be ranked amongst best Computer Engineering departments in the global academic scale and to be a leading pioneer of ground breaking research and cutting-edge technology in the field of Computer Engineering.

MISSION

The mission of the computer engineering department is:

- To prepare competent professionals in Computer Engineering who will take the lead in the industry, academia and government of Nigeria and globally competitive.
- To conduct original research that solves local problems leading to the transfer and dissemination of knowledge to the society while contributing to the advancement of computing technologies worldwide.
- To provide the Nigeria society with high quality technical services in areas related to Computer engineering in terms of training, projects and consultations.

AIM/OBJECTIVES

The specific objectives of the Computer Engineering programme are:

- To produce competent Computer Engineering graduates that would be experts in proffering solutions to problems associated with computer industrialization and governance.
- To produce Computer Engineering graduates who will demonstrate an ability to pursue a successful professional and career growth.
- To produce graduates who will established themselves as successful professional computer engineers with demonstrated leadership capabilities
- To offer globally competitive and locally responsive undergraduate training in Computer Engineering for allied industries.

CAREER OPPORTUNITY

The graduates of Computer Engineering Department have career prospects in the following industrial sectors:

- ❖ Oil and Gas
- ❖ Pharmaceuticals
- ❖ Power Generation
- ❖ Telecoms
- ❖ Automotive
- ❖ Construction
- ❖ Aerospace
- ❖ Defence
- ❖ Marine
- ❖ Transport
- ❖ Chemical
- ❖ Utilities
- ❖ Medicine
- ❖ Agriculture

ADMISSION REQUIREMENTS

To be eligible for admission into the degree programme, all applicants must satisfy the minimum entrance requirements stipulated in the UTME Regulations. That is, all applicants must possess a minimum of five (5) credit passes in either WAEC or NECO Ordinary Level English Language, Physics, Chemistry, Mathematics and any one of the following subjects: Further Mathematics, Biology, Agricultural Science, Economics, Fine and Applied Art, Geography and Technical Drawing at two sittings. An acceptable level of performance in the Joint Matriculation Examination only is required for admission.

STAFF PROFILE

S/N	Name	Area of Specialization	Discipline	Qualification	Rank
1	Engr. Dr. J. E. Okhaifoh	Electronic & Telecommunication	Engineering	PhD (2014), M.Eng (2003), B.Eng (1998), COREN, MNSE, IAENG.	Reader
2	Dr. D. ALLENOTOR	HPC, HCI & Computational Financial Engineering	Science	B.Sc. (1997), M.Sc. (2000), M.Sc. (2005), PhD. (2010)	Reader
3	Engr. Dr. G. O. Uzedhe	Electronic & Computer	Engineering	PhD (2014), M.Eng (2009), B.Eng (2003), IAENG, MNSE, COREN	Senior Lecturer
4	Dr. A. A. OJUGO	Artificial Intelligence	Science	B.Sc. (2000), M.Sc. (2005), PhD. (2013)	Senior Lecturer
5	Engr. Dr. G. Ugwu	Instrumentation & Control	Engineering	PhD (1995), M.Eng (1985), B.Sc (1982), ISA, MNSE, COREN	Senior Lecturer
6	Dr. D. A. OYEMADE	Software Engineering	Science	HND (1987), PGD (2004), M.Sc. (2007), PhD. (2014)	Senior Lecturer

7	Engr. Dr. D. U. Onyishi	Communications	Engineering	Ph.D (2017), M.Eng (2004), B.Eng (2002), IEEE, MNSE, COREN	Senior Lecturer
8	R. A. ABERE	Software Engineering	Science	B.Sc. Comp.Sci 1999, M.Sc. Comp.Sci 2006	Lecturer I
9	Engr. D. Okene	Electronics & Telecommunication	Engineering	M.Eng (2008), B.Eng (2005) MNSE, IEEE, IAENG, COREN	Lecturer I
10	Engr. A. Onyan	Electronics & Telecommunication	Engineering	M. Eng (2012), B.Eng (2006), MNSE, COREN	Lecturer I
11	Engr. C. Igbinoba	Electronics & Telecommunication	Engineering	M. Eng (2012), B.Eng (2010), MNSE, COREN	Lecturer I
12	Engr. K. Enalume	Electronic and Telecommunication	Engineering	M.Eng (2014), B.Eng (2008) MNSE, COREN	Lecturer I
13	Engr. O.Y. Ogundepo	Electronics & Telecommunication	Engineering	M.Eng (2015), B.Eng (2009), COREN	Lecturer II
14	Engr. F. Tanshi	Computer Engineering	Engineering	M.Sc (2015), B.Eng (2011) NIEE, COREN	Lecturer II

COURSE CONTENT FOR 200-500 LEVEL

200-LEVEL

200-LEVEL

FIRST SEMESTER						
COURSE CODE	COURSE TITLE	L	T	P	CREDIT UNIT	STATUS
EEE 211	Basic Electrical Engineering I	2	-	-	2	C
GET 211	Engineering Mathematics I	2	1	-	3	C
GET 212	Engineer - in - Society	2	-	-	2	C
GET 219	Engineering Laboratory I	-	-	6	2	C
MEE 211	Engineering Drawing I	-	-	3	2	C
MEE 212	Engineering Mechanics I	2	-	-	2	C
MEE 213	Basic Manufacturing Technology	2	-	-	2	C
MEE 214	Engineering Materials	2	-	-	2	C
MEE 215	Fluid Mechanics	2	-	-	2	C
MEE 216	Basic Thermodynamics	2	-	-	2	C
PEE 211	Introduction to Oil and Gas Industry	1	-	-	1	C
TOTAL CREDIT UNITS					22	

SECOND SEMESTER						
COURSE CODE	COURSE TITLE	L	T	P	CREDIT UNIT	STATUS
CVE 221	Basic Civil Engineering	2	-	-	2	C
EEE 221	Basic Electrical Engineering II	2	-	-	2	C
GET 221	Engineering Mathematics II	2	1	-	3	C
EEE 222	Information Technology in Engineering	2	1	-	2	C
GET 229	Engineering Laboratory II	-	-	6	2	C
MEE 221	Engineering Drawing II	-	-	3	2	C
MEE 222	Engineering Mechanics II	2	-	-	2	C
GET 223	Basic Workshop Practice	-	-	3	1	C
MEE 224	Strength of Materials I	2	-	-	2	C
CPE 221	Introduction to Database Systems	2	1	-	3	C
GET 299	Student Work Experience Program (SWEP II)	-	-	-	2	C
TOTAL CREDIT UNITS					23	

300 LEVEL

FIRST SEMESTER						
COURSE	COURSE TITLE	L	T	P	CREDI	STATUS

CODE					T UNIT	
CPE 311	Computer Organisation & Architecture	2	1	-	3	C
CPE 312	Software Development Techniques	2	1	-	3	C
EEE 312	Digital Systems Fundamentals	2	1	-	3	C
MEE 317	Basic Safety Engineering	1	-	-	1	C
EEE 311	Circuit Theory I	2	1	-	3	C
CPE 314	Computer Programming with Assembly Language	2	1	-	3	C
GET 311	Engineering Mathematics III (calculus)	3	-	-	3	C
GSE 311	Entrepreneur Studies	2	-	-	2	C
CPL 319	Computer Laboratory I	-	-	3	1	C
TOTAL CREDIT UNITS					22	

SECOND SEMESTER						
COURSE CODE	COURSE TITLE	L	T	P	CREDI T UNIT	STATUS
CPE 321	Microprocessor Systems & Interfacing	2	1	-	3	C
CPE 322	Data Structures and Algorithms	2	1	-	3	C
CPE 323	Signals and Systems	3	-	-	3	
GET 321	Engineering Mathematics IV	3	-	-	3	C
GET 322	Technical Report Writing and Seminar	1	-	-	1	C
CPE 324	Computer Programming with C/C++	2	-	-	2	C
CPL 329	Computer Laboratory III	-	-	3	1	C
GET 399	Student Work Experience Program (SWEP III)	-	-	3	3	C
TOTAL CREDIT UNITS					19	

400 LEVEL

FIRST SEMESTER						
COURSE CODE	COURSE TITLE	L	T	P	CREDI T UNIT	STATUS
EEE 411	Control Systems Engineering I	2	1	-	3	C
EEE 412	Communication Principles	2	1	-	3	C

CPE 413	Computer Networks	2	1	-	3	C
CPE 414	Object Oriented Computer Programming	2	1	-	3	C
CPE 415	Operating Systems	2	1	-	3	C
CPE 416	Prototyping Techniques	2	-	-	2	C
GET 411	Engineering Mathematics IV	2	2	-	3	C
CPE 419	Computer Laboratory II	-	-	3	1	C
TOTAL CREDIT UNITS					21	

COURSE CODE	COURSE TITLE	CREDIT UNIT
GET 429	Student Industrial Work Experience Scheme (SIWES)	6
TOTAL CREDIT UNITS		6

TOTAL CREDIT UNITS	19
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400 LEVEL

FIRST SEMESTER						
COURSE CODE	COURSE TITLE	L	T	P	CREDIT UNIT	STATUS
EEE 411	Control Systems Engineering I	2	1	-	3	C
EEE 412	Communication Principles	2	1	-	3	C
CPE 413	Computer Networks	2	1	-	3	C
CPE 414	Object Oriented Computer Programming	2	1	-	3	C
CPE 415	Operating Systems	2	1	-	3	C
CPE 416	Prototyping Techniques	2	-	-	2	C
GET 411	Engineering Mathematics IV	2	2	-	3	C
CPE 419	Computer Laboratory II	-	-	3	1	C
TOTAL CREDIT UNITS					21	

COURSE CODE	COURSE TITLE	CREDIT UNIT
GET 429	Student Industrial Work Experience Scheme (SIWES)	6
TOTAL CREDIT UNITS		6

500 LEVEL

FIRST SEMESTER						
COURSE CODE	COURSE TITLE	L	T	P	CREDIT UNIT	STATUS
CPE 511	Computer Software Engineering	3	1	-	3	C
CPE 512	Artificial Intelligence	2	1	3	3	C
CPE 513	Reliability and Maintainability of Computer Systems	2	1	-	3	C
CPE 514	Embedded system design	2	1	-	3	C
CPE 515	Digital System design with VHDL	2	1	-	3	C
CPE 516	Computer Security Techniques I	2	1	-	2	C
CPE 517	Cyberpreneurship & Cyberlaw	2	-	-	2	C
GET 511	Engineering Law	2	-	-	2	C
CPE 598	Final Year Project and Seminar	-	-	9	0	C
TOTAL CREDIT UNITS					21	

SECOND SEMESTER						
COURSE CODE	COURSE TITLE	L	T	P	CREDIT UNIT	STATUS
EEE 533	Digital Signal Processing	3	-	-	3	C
CPE 521	Computer Graphics & Animation	3	-	-	3	C
CPE 522	Robotic & Automation				2	C
CPE xxx	Elective				3	E
GET 521	Engineering Management	2	-	-	2	C
CPE 518	Final Year Project and Seminar	-	-	9	6	R
TOTAL CREDIT UNITS					19	

KEY: L = Lecture Hours/Week, T = Tutorial Hours/Week, P = Practical Hours/Week, C = Core, O = Optional, R = Report, E = Elective

ELECTIVES

Elective 1			
Course Code	Course Title	Units	Status
CPE 523	Digital Image Processing	3	E
CPE 524	Design & Installation of Electrical & ICT services	3	E
CPE 525	Cryptography Principles & Applications	3	E

CPE 222: Information Technology In Engineering **3 UNITS**
 Word processing principles of operation, applications and exercises; Spreadsheet principles, applications, demonstration

and hands-on exercises; Database management principles and operations, applications and demonstrations; hands on exercises in use of a popular report presentation package, such as PowerPoint; mini-project to test proficiency in the use of software packages.

Types of computer and components, their uses such as industrial, scientific, etc; computer logic, software and hardware; Introduction to computer languages such as Fortran, Basic, Cobol, Mat Lab etc; application of Fortran and Basic to solution of simple problems; Flow Charts; Practical Exercises in the use of computers; further Computer Programming using Q-Basic, Symbols, Keywords, Data types; Visual Programming using Visual Basic for solving engineering problems; filing system directory; file paths & location.

CPE 221: Introduction to Database Systems

3 UNITS

History and overview of database and management systems including reasons for studying database, database access method, application, role of database in computer engineering. Database Environments: data model hierarchy, network, entity relation, enhanced entity relation, relational database, object oriented database. Relational Data Model: entity relationship modelling. Normalization of Database Tables: data redundancy and associated problems, Normalisation Process, 1NF, 2NF, 3NF, BCNF, 4NF. Query Language: Language paradigms and database languages, user interfaces and graphical query languages, query optimization, data dictionary. Distributed Database System: distributed DBMS concepts and design, distributed relational database, distributed transaction management. Replication and Mobile Databases: basic components of database replication, replication environments, replication servers, mobile databases. Selected database issues: security, concurrency. Introduction to business intelligence, data warehousing, data mining.

300 LEVEL

CPE 311 Computer Organisation and Architecture

3 UNITS

Computer Fundamentals: Development history of computer hardware and software. Hardwired vs. stored program concept. Von-Neuman architecture. Harvard architecture: principle of operation, advantages, disadvantages. Single address machine. Contemporary computers. Computer system: block diagram, functions, examples, dataflow, control line. Computer Arithmetic: integer arithmetic (addition, subtraction, multiplication, division), floating-point representation (IEEE), floating-point arithmetic. arithmetic and logic unit (ALU). Introduction to CISC and RISC architecture: principle of operation, merits, demerits. Storage and Input/Output Systems: Computer function (fetch and execute cycles), interrupts, interconnection structures (Bus structure and bus types), Overview of memory system, memory chip organization and error correction, cache memory, memory storage devices. Overview of I/O, programmed and interrupt-driven I/Os, DMA, I/O channel and I/O processor. Control Unit: Micro-operations, control of the CPU, hardwired implementation, control unit operation, micro-instruction sequencing and execution, micro-programmed control. Use INTEL family, and MOTOROLA family as case study of a CISC computer system. Instruction Set and Register: Machine instruction characteristics, types of operands and operations, instruction functions, addressing modes, instruction formats, register organization, instruction pipelining. High performance computer systems: Techniques to achieve high performance, pipelining, storage hierarchy, units with function dedicated for I/O. RISC, introduction to superscalar processor, parallel processor. Use popular RISC processor (e.g. i960, Motorola PowerPC) as case study. Operating System: Overview of operating system, dimension and type of operating system, high level scheduling, short-term scheduling, I/O scheduling, memory management, virtual memory, UNIX/LINUX operating system: architecture, commands, programming; window based operating systems (MS windows,).

CPE 312 Software Development Techniques**3 UNITS**

Software development life cycle. Top-Down design. Program, design using pseudo-code, flowchart. Flowchart ANSI symbols and usage. Extensive examples, and exercises using pseudo-code/flowchart to solve practical problems in engineering. Debugging and documentation techniques. Programming using a structural language such as C: Symbols, keywords, identifiers, data types, operators, various statements, operator precedence, type conversion, conditional and control structures, function, recursive functions. Arrays: 1-D, and multi-dimensional arrays, passing elements or whole array to a function. Simple sorting and searching on arrays, pointers, strings, dynamic memory allocation. Structures and Unions: Structure declaration and definition, accessing structures, array of structures, pointers and structures, union declaration, enumerated variables. File Handling: Concept of a file, files and streams, standard file handling functions, binary files, random access files. Advanced Topics: Command line parameters, pointers to functions, creation of header files, stacks, linked lists, bitwise manipulation. Software development in C in MS Windows, UNIX/LINUX environments, header file, preprocessor directives, make, makefile. Static and dynamic linking libraries. Extensive examples, and exercises programming in C to solve practical problems in engineering. Exercises are to be done in the Computer Laboratory.

EEE 312: Digital Systems Fundamentals**3 UNITS**

Boolean algebra and the nature of two-value variables. Boolean functions and reduction techniques. Logic gates. Combinational logic circuits. Analysis and design of logic gates of various families. Diode logic, RTL, TTL, ECL, MOS and CMOS of digital integrated circuits. Interfacing between various logic families. Concepts of small, medium, large and very large scale integration and their consequences, some digital building blocks. Flip flop counters, registers and decoders. Introduction to D/A and A/D conversion principles. Triggering in synchronous

systems. Ripple and synchronous counters, latches and registers. **Synchronous sequential systems:** the concept of state, state diagrams and state table. Analysis procedure. Design: Design procedure. State assignment and state reduction. Design implementation in D, JK, T and R-S flip-flops. **Asynchronous sequential systems:** Hazards and race conditions, Elementary circuit analysis. Generation of non-sinusoidal waveforms, astable, monostable and bistable multivibrators.

EEE 311: Circuit Theory I

3 UNITS

Network Theorems, Network Topology, General network solutions. Network Transformations. Time domain analysis of networks. Frequency domain analysis of networks. Fourier series and periodic signals. Applications of Fourier series in network analysis. Fourier transforms and non-periodic signals. Laplace transforms. Application of Laplace transformation to transient analysis of RLC circuits. Transfer function concepts. Reliability of transfer function.

CPE 314 Computer Programming with Assembly Language

3 UNITS

Introduction: Language level of abstraction and effect on machine, characteristics of machine code, advantages , justifications of machine code programming, instruction set and dependency on underlying processor. Intel 8086 microprocessor assembly language programming: Programming model as resources available to programmer, addressing modes, instruction format, instruction set- arithmetic, logical, string, branching, program control, machine control, input/output , etc; assembler directives, hand-assembling, additional 80x86/Pentium instructions. Modular programming. Interrupt and service routine. Interfacing of assembly language to C . Intel 80x87 floating point programming. Introduction to MMX and SSE programming. Motorola 680x0 assembly language programming. Extensive practical engineering problems solving in assembly language using MASM for Intel, and cross-assembler for Motorola.

Domestic Electrical wiring; Radio/TV repairs & Computer; Carving, Weaving; Brick laying/making; Bakery; Tailoring; Welding; Building drawing; Carpentry; Leather tanning; Animal husbandry; Metal Craft.

CPL 319: Computer Laboratory I **2 UNITS**

The assigned laboratory exercises reflect Circuit Theory. Introduction to computer hardware, disassembling and assembling of different computer parts, Internal view of different types of computers: desktops, laptops, Workstations, PDAs, and other handheld devices. Basic electronics components found in the computer system, testing and troubleshooting of computer parts. Introduction to DOS environment: access to user and kernel modes, directories, files. Introduction to software installation: Operating System, application software. Input/Output components of the computer.

CPE 321 Microprocessor System and Interfacing **3 UNITS**

A basic microprocessor system: the CPU, memory, I/O, and buses subsystems, basic operation of a microprocessor system: fetch and execute cycle, the architecture of some typical 8-bit, 16-bit, 32-bit microprocessors, (INTEL, MOTOROLA) and their features. Programming model in real mode: registers, memory, addressing modes. Organisation of the interrupt system, interrupt vectors, and external interrupts, implementation of single and multiple interrupts in real mode. Programming model in protected mode: registers, memory management and address translation, descriptor and page tables, system control instructions, multitasking and memory protection, addressing modes, and interrupt system. Memory interfacing and address decoding. I/O interfacing: memory mapped I/O, isolated I/O, bus timing, I/O instructions. Peripheral devices interfacing: 8255 PPI/6821 PIA, 8251 USART/6821 UART, DMA, Timer/Counter chips, etc. Instruction set. Assembly language Programming of INTEL and MOTOROLA microprocessors. Discussion of a typical system e.g. IBM PC, Apple Macintosh.

CPE 322 Data Structures and Algorithms

3 UNITS

History and overview of data structures and algorithms, role of algorithms in computing. Pointers and Structures: Pointer Data Types and Pointer Variables, Introduction to Structures, Accessing Structure Members, Pointers and Structures as Structure Members. Fundamental concepts: Recursion, Divide-and-Conquer, Backtracking. Data Abstraction and Abstract Data Types (ADT). Fundamental Data Structures: Arrays and Lists. Linked Lists: Introduction to the concepts of linked lists. Doubly linked-list, circular doubly linked list with a sentinel. Applications of linked list. Queues: Introduction to the concepts of queues and double ended-queues. Applications and implementations of queues. Stacks: Introduction to the concepts of stacks. Applications and implementations of stacks. Analysis of Algorithms: Asymptotic Notation, Performance of searching and sorting algorithms. Searching Algorithms: Search algorithms, sequential search, and binary search. Sorting Algorithms: Quick Sort, Merge sort, Selection sort, Insertion sort, Bubble sort. Graphs: Graph representation, Operations on graphs, Graph Traversals, Shortest Path algorithms, Minimal Spanning Trees. Trees: Concepts of trees, binary trees, binary search trees, binary tree traversal algorithms. *Standard Template Library(STL): Components of STL, containers, iterators, algorithms.

CPE 323 Signals and Systems

3 UNITS

History and overview of signals and systems including reasons for studying signals and systems, areas of application, and role of signals and systems in computer engineering. Signals: representation and properties, continuous and discrete time signals, signals in engineering applications. Systems: representation, common system types and classifications, system properties of linearity, causality, BIBO stability, time invariance, memory and invertibility. Difference equation: differential equations, transformation of time domain differential equations to difference equations. Convolution: impulse response, convolution integral, convolution summation, circuit analysis

using convolution. Fourier analysis: signal representation by Fourier series, continuous time Fourier series, discrete time Fourier series, discrete Fourier transform, difference between the transformation methods, circuit analysis using Fourier. Fourier transform: continuous time Fourier transform definition, discrete time Fourier transform, transfer functions. Sampling: sampling theorem, Nyquist criteria, sampling of signals, aliasing, up and down sampling, concept of signal quantization and reconstruction of samples. Laplace transform: Laplace transform integral, properties of Laplace, impulse response, step and ramp functions, inverse transform, poles and zeros, circuit analysis using Laplace transform. Filter circuits: passive and active filter circuits, transfer function.

CPE 324 Computer Programming with C/C++

2 UNITS

History of the C language. Structure of the C/C++ Program. Variables Declarations: Global variables, type and range of variables, declaration of variables, scope of variables, reading and printing of variables. Constants Declarations. The C/C++ Operators: Arithmetic, Relational, Logical, and order of operation precedence. Conditional Instructions. Looping and Iterations. Arrays and Strings: Single and multi-dimensional. Functions: VOID function, Functions and Arrays, Function prototyping. Data Types: Unions, type casting, enumerated types, static variables. Pointers: pointers and variable, pointers and functions, pointers and arrays, arrays of pointers, multi-dimensional arrays and pointers, static initialization of pointer arrays, pointers and structures, common pointer pitfalls. Dynamic Memory Allocation and Dynamic Structures: MALLOC and SIZEOF and FREE, CALLOC and REALLOC, Linked Lists, random number generation, sample full C/C++ program

CPL 329 Computer Laboratory III

1 UNIT

Introduction to information representation, Signals and bits, Logic implementation using discrete logic components (TTL, CMOS). Introduction to Complex Programmable Logic Devices (CPLDs) and Field Programmable Logic Arrays (FPGAs) design

flow: design capture (schematic capture, HDL design entry, design verification and test, implementation (including some of its practical aspects), and debugging. Use of CAD tools to design, simulate and implement digital logic circuits on CPLD and FPGA prototyping boards.

400 LEVEL

EEE 411: Control Systems Engineering I 3 UNITS

Basic concepts and examples of control systems; Feedback, Time response analysis, concept of stability, Routh-Hurwitz criterion; Root-locus techniques, Frequency response analysis, Polar and Bode plots, Nyquist stability criteria. Nichols chart, compensation techniques chart, compensation techniques, introduction to nonlinear systems.

EEE 412: Communication Principles 3 UNITS

Introduction to signals and system, classification of signals, signal operations, analysis and transmission of signals. Amplitude modulation: double sideband, single sideband, and vestigial sideband modulation schemes; simple modulators, power and bandwidth performance. AM signal reception: discrimination, frequency tracking loop and noise performance. Angle modulation: frequency modulation, phase modulation, bandwidth requirements. Sampling theorem, pulse amplitude modulation, pulse width modulation, delta modulation, pulse code modulation - causes and correction of errors in PCM and DM. Line codes, block encoding and Shannon's theorem.

CPE 413 Computer Networks 3 UNITS

History and overview of computer networks including reasons for studying the course, description of the key components of network, networking software and hardware, terminologies, and role of networks in computer engineering. Communication network architecture: networks architecture - point-to-point and multi-point configurations, networking topologies - mesh, star, bus, ring; networking and internetworking devices - routers, repeaters, switches, gateways; connection oriented and

connectionless services. Network protocols: network protocols - syntax, semantics and timing; TCP/IP protocol, OSI layering protocol software, network standard and standardization bodies. LAN and WAN architecture systems: LAN topologies - star, ring and bus; LAN technologies - Ethernet, token Ring, Gigabit Ethernet; error detection and correction, CSMA networks, circuit and packet switching, protocols - IP addressing, IP assignment and configuration, DNS, HTTP, UDP and STMP, IPv4 and IPv6, connection establishment, congestion control, flow control, virtual circuits, quality of service. Client-server computing: client-server interaction, web technologies, characteristics of web servers, support tools for website creation and web management. Data security: basics of secure networks, encryption and privacy, authentication protocols, packet filtering, firewalls, virtual private networks, transport layer security.

CPE 412 Object Oriented Computer Programming 3 UNITS

Programming techniques in unstructured, procedural and modular programming, modular programming problems and strategies. Object-Oriented program development environment tools. Object-Oriented structure and development: classes, inheritance, encapsulation, polymorphism, class derivation, abstract classes, interfaces, static class members, object construction and destruction, namespaces, exception handling, function overloading and overriding, function name overload resolution, container classes, template classes, multiple threads and synchronization. Generic Classes and methods, Applets and Java Web start, Multimedia: Applets and Applications, GUI components, Multithreading. Applications in artificial intelligence, accessing database with JDBC, and software design and Web Services.

CPE 415 Operating Systems 3 UNITS

History and overview of operating systems including reasons for studying operating systems, description of purpose of operating system, services and characteristics of good operating system,

relevance of operating system to computer engineering. Design principles: functions of a typical operating system, mechanisms to support client-server models, design issues, structuring methods, processes and resources, concept of APIs to operating systems, device organization, interrupts and implementations, concepts of user and system states and protection. Concurrency: states and state diagrams, dispatching and context switching, role of interrupt, concurrency execution, mutual exclusion problem and solution, deadlock and its causes and prevention, semaphores and monitors, producer-consumer problems and synchronization. Process scheduling and dispatch: preemptive and non-preemptive scheduling, schedulers and policies, processes and threads, deadlines and real-time issues. Memory management: memory types and hierarchy, memory management hardware, swapping and partitions, paging and segmentation, placement and replacement policies, working sets and thrashing, caching. File systems: files - data, metadata, operations, organization, sequential and non-sequential; directories - content and structure; file system - partitioning, mount and unmount, virtual file; special purpose file, naming, searching access and backups. Device management: characteristics of parallel and serial devices, buffering strategies, direct memory access, recovery from failure. Security: overview of security systems, security methods and devices, protection, access and authentication, models of protection, memory protection, encryption and recovery management.

CPE 416 Prototyping Techniques

2 UNITS

Introduction: Grounding, ground plane, digital ground, analogue ground, power decoupling, inductance and capacitive effects, feedthrough capacitors. Soldering techniques for pass-through and surface mount components, desoldering. Breadboarding, veroboarding. Wire wrapping techniques. Radio Frequency design and implementation techniques. Printed Circuit Board techniques, and production of PCB. Use of PCB CAD packages. Construction exercises using different prototyping techniques.

CPL 419 Computer Laboratory IV

1 UNIT

Introduction to microprocessor/microcontroller circuits operations, troubleshooting of microprocessor/microcontroller systems using oscilloscopes, logic Analyzers, digital Signal generators, Logic Probes, etc. Practical demonstration on microprocessor/microcontroller systems development: use of various prototyping boards and emulators in implementation of microprocessor/microcontroller systems, Implementation of microprocessor/microcontroller systems on circuit boards. Programming of microprocessor/microcontroller: Practical program development in Assembly language, C/C++, etc, Assembling and compilation of source codes, and transfer of object code into microprocessor/microcontroller. Use of CPLDs and FPGAs in practical processor circuits, programming using VHDL, burning of HDL Object code into an FPGA device.

500 LEVEL

CPE 511 Computer Software Engineering

3 UNITS

Introduction to software engineering fundamentals. Object oriented programming. Number representations. Data structure and algorithms, Abstraction, modules and objects. Designing for efficiency. Object oriented software design, implementation and testing. Team software specification and management. Cross-platform tools and GUI development. Advanced software algorithms and architecture. Software engineering practice and methods.

CPE 512 Artificial Intelligence

3 UNITS

History of artificial intelligence, philosophical questions about nature of intelligence, ethical issues in artificial intelligence, nature of knowledge and knowledge based systems, issues of ordering of information, modeling the world. Artificial intelligence design considerations, challenges and issues in artificial intelligence system design. Introduction to LISP programming. Blind and heuristic search concepts and

techniques. Game playing and constraint propagation. Machine learning for classification and pattern recognition. Knowledge representation. Logical Reasoning systems. Uncertainty and Planning. Natural Language Processing. Vision: vision level and segmentation, constraint propagation and matching.

CPE 513 Reliability and Maintainability of Computer Systems 3 UNITS
Introduction to reliability, maintainability, reliability specification and metrics. Application to computer hardware system, communication equipment, power systems, electronic components. Basic maintenance types, and procedures of computer and digital communication system. Fault troubleshooting techniques. QoS and time of availability of data communication. Quality control techniques. Design for higher reliability, fault tolerance. Software Reliability: software reliability specification, software reliability Metrics, fault avoidance, fault tolerance, programming for reliability, software safety and hazard analysis. Comparison of hardware and software reliability. Software Quality and Assurance: definition of software quality, software quality factors, quality control, cost of quality, quality assurance. SQA activities, formal technical reviews, software quality metrics, statistical quality assurance. ISO 9000 Requirements and Certification, ISO 9000-3 for software quality process, process documentation, quality audit. Capability Maturity Model: Software Engineering Institute, levels of maturity, key process areas, Comparison between ISO 9000 Standards and CMM. Ensuring Quality and Reliability: verification and validation, measurement tracking and feedback mechanism, total quality management, risk management.

CPE 514 Embedded System Design 3 UNITS
Introduction to embedded system, components, characteristics, applications. Intel 8051/8031 Micro-controller: Features of the 8051/8031 family, block diagram and definitions of the pin of the 8051, I/O port structure, memory organisation: general purpose RAM, bit addressable RAM, register bank, special function registers, external memory, memory space mapping and

decoding, bus control signals timing, a typical 8051 micro-controller based system. Instruction Set and Assembly Language Programming: Addressing modes, the 8051 instruction set and typical examples, assembler operation, assembly language format, assembler directives, operation of assemblers and linkers, programming examples. On-chip Peripheral Devices: I/O ports, operations and uses of port 0, port 1, port 2, port 3, timers: their operations, programming, and applications, serial port: operations and programming, typical applications, serial port interrupt. Interfacing to external memory, keypad, seven-segment LED display, ADC and DAC chips, and input / output port expansion, description and uses of hardware development tools. MOTOROLA M6811 Micro-controller: Features of the M6811 family, block diagram and definitions of the pin of the M6811, I/O port structure, memory organisation: general purpose RAM, bit addressable RAM, register bank, special function registers, external memory, memory space mapping and decoding, bus control signals timing. Instruction Set and Assembly Language Programming. On-chip peripheral devices and I/O interfacing. Introduction to PIC microcontroller: general architecture, applications and selection of microcontroller, advantages, low-end, and high performance PIC. Specific PIC microcontrollers: Features, architecture, block diagram, pin configuration, on-chip memory, and peripheral. Instruction set and Assembly language programming. Serial I/O interfacing: I2C, and SPI interfacing and programming. Memory interfacing: external memory interfacing, EEPROM and Flash memory interfacing. Design exercises using development system.

CPE 515 Digital System Design with VHDL

3 UNITS

Finite State Machine: definition, mealy and Moore models, state diagram, state table, transition table. Sequential circuits design using flip-flops, asynchronous, and synchronous circuit design. Algorithm State Machine. Design examples and exercises. Structured Design: Design constructs, Design Levels, Geometry-based interchange formats, Computer aided electronic system design tools, Schematic circuit capture, Hardware description

languages, Design process (simulation, synthesis), Structural design decomposition. Introduction to VHDL: VHDL language abstractions, Design hierarchies, VHDL component, Lexical description, VHDL source file, Data types, Data objects, Language statements, Concurrent VHDL, Sequential VHDL, Advanced features of VHDL (library, package and subprograms). Structural level modelling, Register-Transfer level modelling, FSM with data path level modelling, Algorithmic level modelling. Introduction of ASIC, Types of ASIC, ASIC design process, Standard cell ASIC synthesis, FPGA Design Paradigm, FPGA synthesis, FPGA/CPLD Architectures. VHDL Design: Top-down design flow, Verification, simulation alternatives, simulation speed, Formal verification, Recommendations for verification, Writing RTL VHDL code for synthesis, top-down design with FPGA. VHDL synthesis, optimization and mapping, constraints, technology library, delay calculation, synthesis tool, synthesis directives. Computer-aided design of logic circuits.

CPE 516 Computer Security Techniques I

2 UNITS

Introduction: Overview of computer security, attacks and services, control of hardware software. Usage. Intruders, Viruses and Worms: Intrusion techniques. Nontechnical attacks. Password protection and its vulnerability. Intrusion detection. Nature of viruses. Malicious programs. Types of viruses. Antivirus approaches. Worm propagation and countermeasures: access control, intrusion detection and firewalls. Disaster Recovery: Recovery requirements, policy, strategy, technical team. Execution of recovery plans. Documentation and backup system. Loss estimation. Developing Secure Computer System: External Security Measures, Issue, Security Models [Specification and Verification, Bell and LaPadulla Model, Clark-Wilson Model, Goguen-Meseguer, TCPEC], Discretionary Access Requirements, Mandatory Access Requirements, User Authentication, Access and Information Flow Control, Auditing and Intrusion Detection, Damage Control and Assessment, Microcomputer Security. Entropy, perfect secrecy, unicity distance, complexity theory, NP completeness, number theory. Cryptographic System, Public Key

Systems, digital signatures. Network and Telecommunication Security: Fundamentals, Issue, Objective and Threats, Security Services, Distributed System Security, The Trusted Network Interpretation, TNI Security Services, AIS Interconnection Issues, Firewalls [Gateways, Application, Cost and Effectiveness]. Database Security: Security Requirements to Databases, Designing the Security, Methods of Protection, Security of Multilevel Database .

CPE 517 Cyberpreneurship & CyberLaw

2 UNITS

Introduction: Definition of creativity, innovation, examples of creativity leading to innovation, commercialization of creative and innovative ideas. Trends in technology development. Entrepreneurship management and ownership. Characteristics of entrepreneur, starting a new business, business planning, strategic planning & management, site selection and layout. Establishing new venture, risk management. Business Plan Development: definition, need, preparation of business plan. Forecasting developments and charting an action plan . Identifying the product/service, market research and feasibility study. Financing business. Sources of debt financing. Creating the marketing plan, pricing, creative advertising and promotion. Entrepreneurship case studies: Overview and analysis of successful entrepreneurs such as Bill Gates, Michael Dell, David Filo and Jerry Yang of Yahoo, etc. Nigerian Entrepreneurship: Discussion of Nigerian business environment, and illustrated with successful Nigerian entrepreneurs. Overview of the Nigerian Legal System: Civil and criminal. Basic concepts of law. Contract Law. . Current issues: digital signatures, Intellectual property and copyright. Speech Law: Defamation, Sedition, Printing Press Act. Speech on the Internet. Advertising Code: Made in Nigeria rules and guidelines, Advertising Standards. Media and Licensing law in Nigeria: Developing an in-depth understanding of the nature and function of Nigerian media law. Public and Private licensing. Intellectual and moral rights. Music royalties, synchronization rights, performance rights. Role of music publishers. Broadcast rights, merchandising. Detailed analysis of

Communications and Multimedia Act. Ethic and Etiquette: New codes of social behaviour: the right to privacy.

EEE 533 Digital Signal Processing

3 UNITS

Introduction: Advantages of digital over analogue signal processing, problems of digitization, overview of application of DSP, basic elements of DSP system. Digital Processing of analogue signals: Sampling of analogue signals, sampling theorem, aliasing, quantization, noise, and coding, types and selection of ADC/DAC, Sigma-delta ADC. Analytical tools: z-transform, properties, transfer function, inverse z-transform, z-plane poles and zeros, analysis of linear time-invariant in z-domain, system stability. Discrete Fourier Analysis: Discrete Fourier Transform and properties, inverse DFT, truncated Fourier transform, windowing, FFT algorithms. Discrete Time Signals & systems: Discrete time sequences (signals), classification and determination of discrete time system, discrete time i/o description (difference equation), solution of difference equations, convolution, correlation, impulse response. Digital Filters: Definition and types. FIR filters: Transfer function, characteristics, applications, design methods, Gibb's effect and elimination, fir filter realisation. IIR filter: Transfer function, characteristics, applications, overview of analogue filter design techniques, design methods-conversion from analogue to digital filter design techniques, IIR filter realization. Structure of Discrete Time System: Block diagram representation of constant coefficient difference equations, IIR and FIR systems and their basic structures, stability of discrete time systems. Software implementation of dsp algorithms. DSP Microprocessors: Architecture, fixed point vs. floating point DSP, Finite word length effects. DSP chips: interfacing and programming. Practical application of DSP in audio, and video.

CPE 521 Computer Graphics & Animations

3 UNITS

Overview of 3D animation and its application and types. Coordinate system, vertex, faces and object. Concept of wireframe, surface and solid modelling. Construction planes

and differences between object space and world space. Principles of making characters alive. Polygonal Modelling techniques: the Box, using Edit Mesh, Smoothing Techniques, Subdivision Surfaces. Nurbs Modelling techniques: Utilizing NURBS toolbox, surface points and CVs. Importing and attaching NURBS surfaces, rebuilding surfaces, curve and surface approximation. Graphic animation process: Camera & Animation Camera, Set & Background (Image Plane), Light Linking. Animation Techniques: Walk Cycle and Facial Expression using Blend Shape. Dynamics animation: Rigid Bodies, Soft Bodies, constraint, Particles. Tips and tricks on rendering. Concept of Rendering in 3D modelling. Render options and file output.

CPE 522 Robotic & Automation

2 UNITS

Robot classification and manipulation. Technology and history of development of robots. Applications. Direct and inverse kinematics: arm equation. Workspace analysis and trajectory planning. Differential motion and statics. Manipulator dynamics. End-of arm tooling. Automation sensors. Robot vision. Work-cell support systems. Robot and system integration. Safety. Human interface. Robot control system. Circuit and system configuration. Task oriented control. Robot control programming. Fuzzy logic and AI based robot control. Fundamentals of automation. Strategies and economic consideration. Integration of systems. Impact to the production factory. Evaluation of conventional processes. Analysis of automated flow lines. Assembly systems and line balancing. Automated assembly systems. Numerical control and adaptive control. Robot applications. Automated materials handling and storage systems. Automation in inspection and testing. Linear feedback control system. Optimal control. Computer process control. Computer integrated manufacturing systems. Future automated factory.

CPE 523 Digital Image Processing

3 UNITS

Introduction: definition, problems, and applications of digital image processing. Digital image acquisition devices. Digital image formats. Edge detection techniques, segmentation methods.

Image Morphology. Image enhancement. Image restoration techniques. Morphology. Fourier transform and Wavelet transform in image processing. Image registration techniques. Shape analysis. Image understanding. Artificial neural network and image understanding. Colour representation standards, equations, processing, quantization, and dithering. Case study: practical application of image processing to face recognition, fingerprint, iris, etc. Introduction to image compression techniques.

CPE 524 Design & Installation of Electrical & ICT services **3 UNITS**
Electrical Installation: Induction to Health and safety at work act in Nigeria. Electrical safety. First aid. Electricity supply regulations. Lighting and Illumination: Luminous intensity and flux. Maintenance factor. Coefficient of utilization. Types of light sources. Calculation of lighting requirements. Glare. Stroboscopic effect. Installation Materials, cables, junction box, terminations, joints. Conduits and conduiting. Truck and trucking. Electrical Installation design in domestic, commercial and industry. Alarm and emergency systems. Earthing and Protection. Purposes of earthing. Faraday cage. Rod electrodes. Earth electrode resistance. Earthing system. Earth fault loop impedance. ICT services: NCC and FCC codes of practice and standards. Telecommunication design and installation: Satellite, VSAT, etc. Telephone design and installation. Computer networking design and installation. Wireless LAN design and installation. Preparation of Bill of Engineering Measurement Evaluation. Contract bidding. Consultancy.

CPE 525 Cryptography Principles & Applications **2 Units**
History of cryptographic System, Public Key Systems, Digital Signatures. Information Theory: Entropy, Perfect Secrecy, Unicity Distance, Complexity Theory, NP Completeness, Number Theory. Data Encryption Methods : Transposition Ciphers, Substitution Ciphers, Product Ciphers, Exponentiation Ciphers, Knapsack Ciphers, Breakable NP-Complete Knapsack, Encryption Standards

DES, RSA, Elliptic Curves. Cryptographic Techniques: Block and Stream Ciphers, Autokey, Endpoints of Encryption, One-way Ciphers, Password and Authentication, Secret Keys and Public Keys, Threshold Scheme. Video scrambling techniques. Digital video encryption techniques: principle, IRDETO, Viaaccess, Videoguard, etc. Security and Legality Issues: Copyrights, Patents, Trade Secret, Ownership of Products, Computer Crimes, Ethical Issue in Computer Security.

CHAPTER FIVE

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING



ELECTRICAL AND ELECTRONICS ENGINEERING LABORATORY

TITLE OF DEGREE PROGRAMME

This is the degree of Bachelors of Engineering (B.Eng.)

INTRODUCTION

Electrical and Electronics is one of the most diverse fields of engineering in existence. Almost every modern device, equipment and home is powered by fossil fuels, wind energy systems, photovoltaic technology, fuel cell technology, biofuels, geothermal technology, fuel or hydropower systems. The powering of these devices is accomplished by the electrical engineer. State-of-the-art communication gadgets, such as cell phones, satellites, and the internet, are designed based on technologies created by the electrical engineer. The advancement of technology has led to a rapidly automated society. The automotive control of machines is the responsibility of the electrical engineering has also become indispensable in the field of medicine. Electrical engineers play a pivotal role in the generation, acquisition and interpretation of medical images used in the diagnosis and treatment of diseases. Many medical devices, such as prosthetic limbs for amputees and robotic hands to assist surgeons in operating rooms, are designed and fabricated with the assistance of the electrical engineer.

While the Federal University of Petroleum Resources is a specialized university that caters to the needs of the Oil and Gas Industry, the department of electrical engineering offers a broader range of expertise. New students coming into the programme are first put through a rigorous training in mathematics and core science subjects to ensure a proper foundation of engineering. Secondly, students are exposed to foundation courses in the different fields of engineering to give them a general understanding of engineering. The students are then introduced to the core electrical engineering courses in the

third year. In the fourth year, students gain practical industrial experience by partnering with local industries in the executive of the Students Industrial Work Experience Scheme (SIWES). In their fifth and final year, students in the Electrical and Electronics Engineering program are offered three options, namely:

- o Instrumentation and control
- o Electronics and telecommunication
- o Power and Machines

Students can specialize in any option by taking some of the elective courses in that option. Upon completion of the programmes, students are qualified to pursue lucrative careers in many industries, such as the oil and gas industry, power industry, biomedical industry, communication industry, robotics industry, electronics industry and instrumentation industry.

PHILOSOPHY

- o Development and provision of special engineering education geared towards the achievement of national goals and objectives of industrialization and self reliance.
- o Provision of training in the theory and practice of engineering.
- o Early introduction of students to entrepreneurial education and training.
- o Acquisition of practice industrial experience for students by partnering with local industries in the execution of the Students Industrial Work Experience Scheme (SIWES).

VISION

To be ranked number one among all EEE departments in all Africa and to be leading pioneer of ground breaking research and cutting-edge technology in the field of EEE.

MISSION

To produce research-oriented, technically-sound graduates that are well equipped to be outstanding professional leaders of excellence in Africa and in the global world.

AIM/OBJECTIVES

The Department of Electrical and Electronics Engineering at the Federal University of Petroleum resources has the following objectives:

- o To produce top-tier graduates who are professionally competent to work in both the private and the public sector of the economy.
- o To produce graduate capable of initiating and carrying out engineering design and studies.
- o To produce graduates equipped to participate in the management of industrial production operations.
- o To produce graduates that are strongly inclined towards research and development activities.

ADMISSION REQUIREMENTS

To be eligible for admission into the degree programmes of the Department of Electrical/Electronic Engineering, all applicants must satisfy the minimum entrance requirements stipulated in the UTME Regulations. That is, all applicants must possess a minimum of five (5) credit passes in either WAEC or NECO ordinary level English, Mathematics, Physics and Chemistry examinations, and any one of the following subject: Further Mathematics, Biology, agricultural Science and Technical Drawing, Economics, Geography and Fine and Applied Art. In addition, applicants must obtain the minimum cut-off points in UTME and PUTME (or equivalent) for the degree programme in the same cluster of five subjects.

STAFF PROFILE

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

S/ N	NAME OF STAFF	CADRE	QUALIFICATION	SPECILIZATION	APPOINTMENT
1	OFUALAGBA, Godswill	Reader	PhD, M.Eng; B.Eng; COREN	Power/Machines	Permanent Ag. Dean, College of Engineering and Technology
2	OKAIFOH, Joseph Ebosetale	Reader	PhD, M.Eng; B.Eng; MNSE; COREN	Electronics and Telecommunications	Permanent
3	UZEDHE, Obruozie. GODWIN	Senior Lecturer	PhD, M.Eng; B. Eng; MNSE; COREN	Computer / Control	Permanent
4	ONYISHI, Donatus Uchechukwu	Senior Lecturer	PhD, M.Eng; B.Eng; MNSE; COREN	Electronics and Telecommunications	Permanent Ag. Head of Department of Electrical and Electronics Engineering
5	OSHEVIRE, O. Patrick	Senior Lecturer	PhD; M.Eng; B.Eng; MNSE; COREN	Power/ Machines	Permanent
6	OKHUEIGBE, E. Ighodalo	Senior Lecturer	PhD; M.Eng; B.Eng; MNSE; COREN	Power/Machines	Permanent
7	EJOFODOMI, O'tege Akpowhene	Senior Lecturer	DSc; MSc.; BSc	Automation and Robotics	Permanent
8	ODIGWE, Ishioma	Lecturer I	M.Eng; B.Eng; MNSE; COREN	Power/ Machines	Permanent
9	OGBEKHIULU, A. Joseph	Lecturer I	M.Eng; B.Eng; MNSE; COREN	Power/ Machines	Permanent
10	OKENE, David Ese	Lecturer I	M.Eng; B.Eng; MNSE; COREN	Electronics/ Telecom	Permanent
11	ONYAN, Aaron Okimute	Lecturer I	M.Eng; B.Eng; MNSE; COREN	Electronics/Robotics	Permanent
12	IGBONOBA, Kevwe Charles	Lecturer I	M.Eng; B.Eng; MNSE; COREN	Electronics/Telecom	Permanent
13	ENALUME, Kingsley	Lecturer I	M.Eng; B.Eng. MNSE COREN	Electronics and Telecom	Permanent
14	AKINLOYE, Benjamin	Lecturer I	M.Eng; B.Tech MNSE; COREN	Machines/Drives	Permanent
15	OGUNDEPO Oludare Yinka	Lecturer I	M.Eng; B. Tech; MNSE; COREN	Artificial Intelligence	Permanent
16	FOGHOR, Tanshi	Lecturer II	PhD; M.Eng; B.Eng. COREN	Artificial Intelligence	Permanent
17	NYONG_BASSEY, E. Bassey	Lecturer II	PhD; M.Eng; B.Eng.	Control Engineering	Permanent
18	UDOHA Ezenwa	Lecturer II	M.Eng; B.Eng	Renewable Energy	Permanent
19	OGHALAa Benjamin. O.	Assistant Chief Technologist	B.ng; HND	Electrical/Electronic Engineering	Permanent

20	AKPOS, Orusede Anthony	Technologist II	HND, OND		Permanent
21	MESHARUN C.E	Assitant Chief Technologist	B.ng; HND	Electrical/Electronic Engineering	Permanent
22	USIDAME O.M	Principal Technologist	HND	Electrical/Electronic Engineering	Permanent
23	OWHO Rebecca .O	Principal Technologist	M.Eng; B.Eng; HND	Electronics and Telecom	Permanent
24	AMAKIRI. O. F	Senior Technologist	B.Ed. PGD; M.Tech	Power and Machines	Permanent
25	OSEMWENGIE Gideon .O	Technologist I	MSc; BSc	Computer Engineering	Permanent
26	MEETING E	Technical Officer	OND	Electrical/Electronic Engineering	Permanent
27	ODUBU E	Foreman	WASC		Permanent
28	OTASOWIE-IGBINOBA Jimima	Assistant Registrar	B.Ed	Accounting	Permanent
29	DENNAR Chidi	Principal Executive Officer II	HND	Banking and Finance	Permanent

UNDERGRADUATE COURSE STRUCTURE FOR 200-500 LEVELS

200 LEVEL

FIRST SEMESTER							
COURSE CODE	COURSE TITLE	L	T	P	CREDIT UNIT	STATUS	
EEE 211	Basic Electrical Engineering I	2	-	-	2	C	
GET 211	Engineering Mathematics I	2	1	-	3	C	
GET 212	Engineer -in- Society	1	1	-	2	C	
GET 219	Engineering Laboratory I	2	-	-	2	C	
MEE 211	Engineering Drawing I	-	-	3	2	C	
MEE 212	Engineering Mechanics I	2	-	-	2	C	
MEE 213	Basic Manufacturing Technology	2	-	-	2	C	
MEE 214	Engineering Materials	2	-	-	2	C	
MEE 215	Fluid Mechanics I	2	-	-	2	C	
MEE 216	Basic Thermodynamics	2	-	-	2	C	
PEE 211	Introduction to Oil and Gas Industry	-	-	9	1	C	
TOTAL CREDIT UNITS					22		

SECOND SEMESTER						
COURSE CODE	COURSE TITLE	L	T	P	CREDIT UNIT	STATUS
CVE 221	Basic Civil Engineering	2	1	-	2	C
EEE 221	Basic Electrical Engineering II	2	1	-	2	C
GET 221	Engineering Mathematics II	2	-	-	3	C
EEE 222	Information Technology in Engineering	-	-	3	2	C
GET229	Engineering Laboratory II	2	-	-	2	C
MEE 221	Engineering Drawing II	-	-	3	2	C
MEE 222	Engineering Mechanics II	2	-	-	2	C
GET 223	Basic Workshop Practice	2	-	-	1	C
MEE 224	Strength of materials I	-	-	9	2	C
GET 299	Student Work Experience Programme (SWEP) I	-	-	-	2	C
TOTAL CREDIT UNITS					20	

300 LEVEL

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FIRST SEMESTER						
COURSE CODE	COURSE TITLE	L	T	P	CREDIT UNIT	STATUS
GSE 311	Entrepreneurial Studies	2	-	-	2	C
EEE 311	Circuit Theory I	2	1	-	3	C
EEE 312	Digital Systems Fundamentals	2	1	-	3	C
EEE 313	Electromagnetic Field & Waves I	2	1	-	3	C
EEE 314	Physical Electronics	2	1	-	3	C
EEE 315	Electrical Machines I	2	-	-	2	C
GET 311	Engineering Mathematics III	2	1	-	3	C
MEE 317	Basic Safety Engineering	1	-	-	1	C
EEE 319	Electrical Laboratory I	-	-	9	2	C
TOTAL CREDIT UNITS					22	

SECOND SEMESTER						
COURSE CODE	COURSE TITLE	L	T	P	CREDIT UNIT	STATUS
EEE 320	Measurement and Instrumentation	2	1	-	3	C
EEE 321	Circuit Theory II	2	1	-	3	C
EEE 322	Electric Power Systems Principles	2	1	-	3	C
EEE 323	Electromagnetic Field & Waves II	2	1	-	3	C
EEE 324	Applied Electronics I	1	1	-	2	C
GET 321	Engineering Mathematics IV	3	-	-	3	C
GET 322	Technical Report Writing and Seminar	1	-	-	1	C
EEE 329	Electrical Laboratory II	-	-	9	2	
GET 399	Student Work Experience Programme (SWEP) III	-	-	-	3	C
TOTAL CREDIT UNITS					23	

400LEVEL

FIRST SEMESTER						
COURSE CODE	COURSE TITLE	L	T	P	CREDIT UNIT	STATUS
EEE 411	Control Systems Engineering I	2	1	-	3	C
EEE 412	Communication Principles I	2	1	-	3	C
EEE 413	Microcomputer Hardware and Software Techniques	2	1	-	3	C
EEE 414	Electrical Machines II	2	-	-	2	C
EEE 415	Applied Electronics II	2	-	-	2	C
GET 411	Engineering Mathematics V	2	1	-	3	C
EEE 419	Electrical Laboratory III	-	-	9	3	C
TOTAL CREDIT UNITS					20	

SECOND SEMESTER		
COURSE CODE	COURSE TITLE	CREDIT UNIT
GET 429	Student Industrial Work Experience Scheme (SIWES)	6
TOTAL CREDIT UNITS		6

500 LEVEL

FIRST SEMESTER						
COURSE CODE	COURSE TITLE	L	T	P	CREDIT UNIT	STATUS
EEE 511	Reliability and Maintainability of Components & Systems	2	-	-	2	C
EEE 512	Control Systems Engineering II	2	1	-	3	C
EEE 513	Advanced Circuit Techniques	2	-	-	2	C
EEE 514	Software Engineering	2	-	-	2	C
EEE 515	Renewable Energy	2	-	-	2	C
EEE 516	Mechatronics I	2	-	-	2	C
EEE 517	Electrical Services Design	2	1	-	3	C
EEE 518	Advanced Computer Programming	2	1	-	3	C
EEE 598	Final Year Project and Seminar	-	-	9	0	C
GET 511	Engineering Law	2	-	-	2	C
TOTAL CREDIT UNITS					21	

For second semester, the 500 level students must choose ONLY ONE of the following three (3) Areas of Interest:

(A) INSTRUMENTATION AND CONTROL

SECOND SEMESTER						
COURSE CODE	COURSE TITLE	L	T	P	CREDIT UNIT	STATUS
EEE 521	Oil and Gas Instrumentation	2	1	-	3	C
EEE 526	Advanced Control Engineering	2	-	-	2	C
EEE 523	Process Control	2	-	-	2	C
EEE 524	Artificial Intelligence and Robotics	2	-	-	2	C
EEE 525	Mechatronics II	1	-	-	1	C
EEE 533	Digital Signal Processing	2	-	-	2	C
GET 521	Engineering Management	2	-	-	2	C
EEE 598	Final Year Project and Seminar	-	-	9	6	C
TOTAL CREDIT UNITS					20	
EEE 537	Optoelectronics	2	-	-	2	O
EEE 527	Finite Element Modeling	2	-	-	2	O

MEE 525	Industrial Automation	2	1	-	3	O
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(B) COMMUNICATIONS AND ELECTRONICS

SECOND SEMESTER						
COURSE CODE	COURSE TITLE	L	T	P	CREDIT UNIT	STATUS
EEE 531	Digital Communication Systems	2	-	-	2	C
EEE 532	Communication Systems Engineering	2	1	-	3	C
EEE 533	Digital Signal Processing	2	-	-	2	C
EEE 543	Power Electronics and Devices	2	1	-	3	C
EEE 525	Mechatronics II	1	-	-	1	C
GET 521	Engineering Management	2	-	-	2	C
EEE 598	Final Year Project and Seminar	-	-	9	6	C
	TOTAL CREDIT UNITS				19	
EEE 537	Optoelectronics	2	-	-	2	O
EEE 538	Electro Acoustics	2	-	-	2	O
EEE 539	Introduction to VLSI Technology	2	-	-	2	O
MEE 525	Industrial Automation	2	1	-	3	O

(C) INSTRUMENTATION AND CONTROL

SECOND SEMESTER						
COURSE CODE	COURSE TITLE	L	T	P	CREDIT UNIT	STATUS
EEE 521	Oil and Gas Instrumentation	2	1	-	3	C
EEE 526	Advanced Control Engineering	2	-	-	2	C
EEE 523	Process Control	2	-	-	2	C
EEE 524	Artificial Intelligence and Robotics	2	-	-	2	C
EEE 525	Mechatronics II	1	-	-	1	C
EEE 533	Digital Signal Processing	2	-	-	2	C
GET 521	Engineering Management	2	-	-	2	C
EEE 598	Final Year Project and Seminar	-	-	9	6	C
	TOTAL CREDIT UNITS				20	
EEE 537	Optoelectronics	2	-	-	2	O
EEE 527	Finite Element Modeling	2	-	-	2	O
MEE 525	Industrial Automation	2	1	-	3	O

SPECIALIZATION OPTIONS FOR B.ENG (ELECT/ELECT ENG.)**(D) INSTRUMENTATION AND CONTROL**

SECOND SEMESTER						
COURSE CODE	COURSE TITLE	L	T	P	CREDIT UNIT	STATUS
EEE 521	Oil and Gas Instrumentation	2	1	-	3	C
EEE 526	Advanced Control Engineering	2		-	2	C
EEE 523	Process Control	2	-	-	2	C
EEE 524	Artificial Intelligence and Robotics	2	-	-	2	C
EEE 525	Mechatronics II	1	-	-	1	C
EEE 533	Digital Signal Processing	2	-	-	2	C
GET 521	Engineering Management	2	-	-	2	C
EEE 598	Final Year Project and Seminar	-	-	9	6	C
	TOTAL CREDIT UNITS				20	
EEE 537	Optoelectronics	2	-	-	2	O
EEE 527	Finite Element Modeling	2	-	-	2	O
MEE 525	Industrial Automation	2	1	-	3	O

(E) COMMUNICATIONS AND ELECTRONICS

SECOND SEMESTER						
COURSE CODE	COURSE TITLE	L	T	P	CREDIT UNIT	STATUS
EEE 531	Digital Communication Systems	2	-	-	2	C
EEE 532	Communication Systems Engineering	2	1	-	3	C
EEE 533	Digital Signal Processing	2	-	-	2	C
EEE 543	Power Electronics and Devices	2	1	-	3	C
EEE 525	Mechatronics II	1	-	-	1	C
GET 521	Engineering Management	2	-	-	2	C
EEE 598	Final Year Project and Seminar	-	-	9	6	C
	TOTAL CREDIT UNITS				19	
EEE 537	Optoelectronics	2	-	-	2	O
EEE 538	Electro Acoustics	2	--	-	2	O
EEE 539	Introduction to VLSI Technology	2	-	-	2	O
MEE 525	Industrial Automation	2	1	-	3	O

For second semester, the 500 level students must choose ONLY ONE of the following three (3) Areas of Interest:

(F) INSTRUMENTATION AND CONTROL

SECOND SEMESTER						
COURSE CODE	COURSE TITLE	L	T	P	CREDIT UNIT	STATUS
EEE 521	Oil and Gas Instrumentation	2	1	-	3	C
EEE 526	Advanced Control Engineering	2		-	2	C
EEE 523	Process Control	2	-	-	2	C
EEE 524	Artificial Intelligence and Robotics	2	-	-	2	C
EEE 525	Mechatronics II	1	-	-	1	C
EEE 533	Digital Signal Processing	2	-	-	2	C
GET 521	Engineering Management	2	-	-	2	C
EEE 598	Final Year Project and Seminar	-	-	9	6	C
	TOTAL CREDIT UNITS				20	
EEE 537	Optoelectronics	2	-	-	2	O
EEE 527	Finite Element Modeling	2	-	-	2	O
MEE 525	Industrial Automation	2	1	-	3	O

(G) COMMUNICATIONS AND ELECTRONICS

SECOND SEMESTER						
COURSE CODE	COURSE TITLE	L	T	P	CREDIT UNIT	STATUS
EEE 531	Digital Communication Systems	2	-	-	2	C
EEE 532	Communication Systems Engineering	2	1	-	3	C
EEE 533	Digital Signal Processing	2	-	-	2	C
EEE 543	Power Electronics and Devices	2	1	-	3	C
EEE 525	Mechatronics II	1	-	-	1	C
GET 521	Engineering Management	2	-	-	2	C
EEE 598	Final Year Project and Seminar	-	-	9	6	C
	TOTAL CREDIT UNITS				19	
EEE 537	Optoelectronics	2	-	-	2	O
EEE 538	Electro Acoustics	2	--	-	2	O
EEE 539	Introduction to VLSI Technology	2	-	-	2	O
MEE 525	Industrial Automation	2	1	-	3	O

300 LEVEL**EEE 311: CIRCUIT THEORY I 3 UNITS**

Network Theorems, Network Topology, General network solutions. Network Transformations. Time domain analysis of networks. Frequency domain analysis of networks. Fourier series and periodic signals. Applications of Fourier series in network analysis. Fourier transforms and non-periodic signals. Laplace transforms. Application of Laplace transformation to transient analysis of RLC circuits. Transfer function concepts. Reliability of transfer function.

EEE 312: DIGITAL SYSTEMS FUNDAMENTALS 3 UNITS

Boolean algebra and the nature of two-value variables. Boolean functions and reduction techniques. Logic gates. Combinational logic circuits. Analysis and design of logic gates of various families. Diode logic, RTL, TTL, ECL, MOS and CMOS of digital integrated circuits. Interfacing between various logic families. Concepts of small, medium, large and very large scale integration and their consequences, some digital building blocks. Flip flop counters, registers and decoders. Introduction to D/A and A/D conversion principles. Triggering in synchronous systems. Ripple and synchronous counters, latches and registers. **Synchronous sequential systems:** the concept of state, state diagrams and state table. Analysis procedure. Design: Design procedure. State assignment and state reduction. Design implementation in D, JK, T and R-S flip-flops. **Asynchronous sequential systems:** Hazards and race conditions, Elementary circuit analysis. Generation of non-sinusoidal waveforms, astable, monostable and bistable multivibrators.

EEE 313: ELECTROMAGNETIC FIELD AND WAVES I 3 UNITS

Review of electromagnetic laws in integral form, Gauss Law, Ampere's and Faraday's laws. Electrostatic fields due to distribution of charge. Magnetic fields in and around current carrying conductors. Time varying magnetic and electric fields. Laplace and poisson equations. Electric displacements, dipoles, boundary conditions. Uniqueness theorem. Conduction and displacement current. Maxwell's equation (in rectangular co-ordinates and vector-calculus notations). Derivation of Maxwell's equation.

EEE 314: PHYSICAL ELECTRONICS**3 UNITS**

Free electron motion in static electric and magnetic fields. Electronic structure of matter, conductivity in crystalline solids. Theory of energy bands in conductors, insulators and semiconductors; electrons in metal and electron emissions. Intrinsic and extrinsic semiconductors, doping. Carrier and transport phenomena in semiconductor. The P-N junction, diode equation, junction break down, junction capacitances. Zener diode. Bipolar junction transistor structure and operation. BJT characteristics. Field effect transistors, pinch-off voltage, FET characteristics. Characteristics of SCRs, vacuum tubes, photo devices (photoresistors, photodiodes, phototransistors, light emitting diodes). Elementary discrete devices fabrication technique and introduction to IC technology and fabrication.

EEE 315: ELECTRICAL MACHINES I**2 UNITS**

Electromagnetic Theory: field intensity, flux, magnetic circuits, inductor circuit. Electromechanical conversion principles: mechanical energy in basic electromechanical system, torque production, generalized electrical machine.

DC Machines: Classification, linear dc machines, principle of operation, operating characteristics, force equation, basic structure of dc machines, magnetic circuit of a dc machine and magnetization curve, EMF and torque equations, speed equation, excitation methods, equivalent circuits, performance of dc generators and motors; commutation, rating, efficiency, review of excitation methods and performance, applications, equivalent circuits, phasor diagrams, operating characteristics, armature reaction, interpoles, compensation windings.

D.C. Generators: Equivalent circuit Magnetization curve. Separately excited; shunt, series and compound generators. Parallel operation.

D.C. Motors: Equivalent circuit, Separately excited; Shunt, permanent magnet, series and compound motors, starting and speed control of dc motors.

Transformers: Introduction, e.m.f equation of a transformer, Features, principle of operation, ideal transformers, equivalent circuits, sinusoidal excitation, primary and secondary side referred equivalent

circuits, phasor diagram, regulation, efficiency, rating, three phase

delta/star connections, core types and shapes, winding, cooling; inrush currents; voltage regulation, performance losses and efficiency; harmonics in three phase transformers; parallel operation; autotransformers, instrument transformers, saturable reactors.

MEE 317: BASIC SAFETY ENGINEERING 1 UNIT

Principles of general safety and safety education; home safety, safe working practices; electrical safety; mechanical hazards; chemical hazards; environmental hazards; safety in hazardous area; industrial Safety and analysis; fire safety, personal protection and fire arm safety; Road traffic and pedestrian safety; Occupational safety; Natural and man-made disasters; Health assurance

EEE 319: ELECTRICAL LABORATORY I 2 UNITS

The assigned laboratory exercises reflect Circuit Theory I, Electrical Machines I, Physical Electronics, Digital Systems Fundamentals; Verification of Diodes Characteristics (using crystal and zener diodes), Verification of Transistor Characteristics in DC and AC circuits (using Bipolar and Field Effect transistors), Soldering Techniques and construction, Design/implementation of transistor circuits (Switching, amplifier and power circuits) and measurement of basic transistor parameters. Logic gates experiments (AND, OR, NAND, NOR and XOR) and application circuits (e.g. adders, subtracting, comparators etc.), DC Machines; Measurement of circuit parameters and performance characteristics of DC motors and generators (separately excited, shunt, series compound).

EEE 320: MEASUREMENT AND INSTRUMENTATION 3 UNITS

Measurement parameters and units. Basic meter in DC and AC measurements; Basic meter in AC measurements; DC and AC Bridges and their applications. Electronic instrument for the measurement of voltage, current, resistance and other circuit parameters. Instruments for generating and analyzing waveforms. Digital/analog and analog/digital conversion. Methods of locating cable faults. Operation of various types of Transducers: resistive type (strain gauge, potentiometer, thermistor, thermocouples), capacitive type (parallel

EEE 324: APPLIED ELECTRONICS I 2 UNITS

Classification on Amplifiers, representation of an amplifier circuit as a

voltage, current, Transresistance and transconductance amplifier. Biasing and stabilization of BJT and FET circuits. Small-signal representation of active devices. Small signals analysis of single and multi-stage amplifier at midband. Low frequency and high frequency response of single and multi-stage amplifiers. Bode plots and frequency response of amplifiers. Analysis of broadband and narrowband amplifiers and other communication circuits. Feedback on gain, input and output impedances. Analysis of feedback amplifiers. Stability and compensation techniques. Schmitt trigger and time base generators using discrete transistors.

EEE 329: ELECTRICAL LABORATORY II 2 UNITS

The assigned laboratory exercises reflect Circuit Theory II, Measurement and Instrumentation, Electric Power Systems and Applied Electronics I: Operational Amplifiers (OP-AMP) experiments (inverters and non-inverter amplifier circuits, voltage follower, summing amplifier, differential amplifier, comparator circuits), Filter circuits experiments design(s) and implementation using modules and discrete components, Oscillator circuit experiments/designs and implementation (e.g. Wien Bridge etc.), Sequential circuit applications and implementation: XOR circuits, D, JK, T and R-S flip flops, Renewable Energy experiments (Solar, Wind, Hydro, Chemical, Nuclear).

400 LEVEL**EEE 411: CONTROL SYSTEMS ENGINEERING I 3 UNITS**

Basic concepts and examples of control systems; Feedback, Time response analysis, concept of stability, Routh-Hurwitz criterion; Root-locus techniques, Frequency response analysis, Polar and Bode plots, Nyquist stability criteria. Nicholas chart, compensation techniques chart, compensation techniques, introduction to nonlinear systems.

EEE 412: COMMUNICATION PRINCIPLES 3 UNITS

Introduction to signals and system, classification of signals, signal operations, analysis and transmission of signals. Amplitude

modulation: double sideband, single sideband, and vestigial sideband modulation schemes; simple modulators, power and bandwidth

performance. AM signal reception: discrimination, frequency tracking loop and noise performance. Angle modulation: frequency modulation, phase modulation, bandwidth requirements. Sampling theorem, pulse amplitude modulation, pulse width modulation, delta modulation, pulse code modulation – causes and correction of errors in PCM and DM. Line codes, block encoding and Shannon's theorem.

EEE 413: MICROCOMPUTER HARDWARE & SOFTWARE TECHNIQUES 3 UNITS

Elements of digital computer design; Comparison of hardwired versus programmable digital systems; Block diagram of digital computer and description of its components, Microcomputer systems: the CPU, memory organization, I/O, and bus organization and addressing schemes. Microcomputer Systems Architecture: the Von-Neuman and Harvard Architectures, bus control, instruction execution and addressing modes. Memory system: static, dynamic, VRAM, and applications. Memory interfacing and address decoding. Machine codes, assembly language and high-level language programming, Micro-processors as state machines. Microprocessor instruction set, format and addressing mode. Microprocessor interfacing: Input/output, interrupt systems and direct memory access; interfacing to analogue systems and applications to D/A and A/D converters. System development tools: simulators, EPROM programming, assemblers and loaders. Microcontrollers (8051 based, PIC, AVR, Arduino, etc.), microcontroller programming and interfacing, application of microcontrollers in embedded systems.

EEE 414: ELECTRICAL MACHINES II 2 UNITS

Synchronous Machines: E.m.f equation, Theory of the cylindrical motor machines, synchronous reactance and voltage regulation by different methods, parallel operation and operation on finite bus bars, types – salient and cylindrical; circle diagram and V – curves; synchronous generator on infinite bus bar, Synchronous motor.

Induction machines: Induction motor; Construction, characteristics, torque/slip relations, Squirrel-cage and wound rotor machines, rotating magnetic field, slip, equivalent circuit and measurement of its parameters,

calculation of currents and torques, performance and speed control, single phase induction motor, types and methods of starting, performance review and applications; synchronous, linear induction motors, parallel operation, three phase induction motors, Capacitor start induction motor, the shaded-pole motor, Induction generator, steady state operation, speed control, operating characteristics and efficiency.

Special motors; reluctance motors, Fractional horse-power Motors, Universal Motors and Hysteresis Motors.

EEE 415: APPLIED ELECTRONICS II 2 UNITS

Feedback oscillators and the Barkhausen criterion. Practical oscillator circuits: phase-shift, Wien bridge, Hartley, Colpitt, Crystal, etc. Frequency stability of oscillators. Ideal operational Amplifier. Connection as a non-inverting amplifier. The differential amplifier, transfer characteristics of the differential (Differential amplifier as a modulator and multiplier). Operational amplifier parameters (common-mode rejection ratio, offset voltages and currents etc). Class A, AB, B and push-pull power amplifiers. Analysis of power amplifiers and heat sinks. Thermal stabilization. Complementary and quasi-complementary output stages. Electronically regulated power supplies. Current limiting and feedback current limiting protection.

EEE 419: ELECTRICAL LABORATORY III 3 UNITS

The assigned laboratory exercises reflect Control Engineering I, Communication Principles, Electrical Machines II and Applied Electronics II; Experiments on the application of Logic gates and Integrated Circuits (ICs, Decoding, Multiplexing, Arithmetic circuits, subtracting, Registers inclusive of PISO and SIPO, Counters, Analog to Digital Converters (ADC), Digital to Analog Converters (DAC). Experiments on signal generation and processing (Amplitude Modulation (AM) and Detection (Single and Double side bands), Frequency Modulation (FM) and Detection. Time and Frequency domain measurement of control systems response: Gain, Lag and Lead Compensation of a closed loop servo system; closed loop control of non-linear control system; performance verification of analog, hybrid and digital control of servo motor position.

500 LEVEL**EEE 511: RELIABILITY AND MAINTAINABILITY OF COMPONENTS AND SYSTEMS 2 UNITS**

Introduction to reliability, maintainability availability; elementary reliability theory. Application to power systems and electronic components. Test characteristics of electrical and electronic components. Types of fault. Designing for higher reliability, fault tolerance. Packaging, mounting, ventilation. Protection from humidity, dust. etc.

Basic maintenance types. Fault troubleshooting techniques. Qos and time availability of data communication. Quality control techniques.

Software reliability; specification and metrics. Programming for reliability, software safety and hazard analysis. Comparison of hardware and software reliability. Software quality and assurance. Software quality metrics. Ensuring quality and reliability, verification and validation, measurement tracking and feedback mechanism, total quality management, risk management.

EEE 512: CONTROL SYSTEMS ENGINEERING II 3 UNITS

State space representation of Linear Systems, solution of state equations: state variable feedback, observability and controllability; pole assignment state space trajectories, linearization; properties and synthesis of multivariable control systems; introduction to Digital Control.

EEE 513: ADVANCED CIRCUIT TECHNIQUES 2 UNITS

Analysis and design of integrated operational amplifiers and advanced circuit such as wideband amplifiers, instrumentation amplifiers, multiplier circuits, voltage controller oscillators, and phase locked loops, design techniques for advanced analogue circuits containing transistors and operational amplifiers. Simulation of circuit using appropriate packages e.g. PSPICE, Electronic workbench, Visio technical etc. should encouraged.

EEE 514: SOFTWARE ENGINEERING 2 UNITS
Structured programming concepts. Introduction to PASCAL. Data structures. Data base principles. Planning a software project: software life cycle. Organizational structure (management of streams). Planning: bar charts, activity networks. Software attributes, elements of software costing. Software specification. Software design. Design concepts modularity, hiding, etc. design notations-data flow diagrams, structure charts, psuedocode, HIPO diagrams etc. Design techniques: stepwise refinement, top-down, structured design etc. elements of software design assignment (team approach). Advanced D-base applications, use of spreadsheets and CAD packages in electronic engineering

EEE 515: RENEWABLE ENERGY 2 UNITS
Introduction to renewable energy technologies/systems: wind energy systems, photovoltaic technology, fuel cell technology, biofuel, geothermal technology and hydropower systems; Design processes: orientation, sizing, specification, design tools, maintenance, limitations of implementing/integrating renewable technologies/systems within building.

EEE 516: MECHATRONICS 1 2 UNITS
Introduction: Mechatronics: What and Why? Mechatronics system design, sensors and transducers for displacement, proximity, velocity, force, pressure, temperature measurement; Microprocessors-Introduction, structure micro - controllers, application, Introduction to Data Acquisition and Virtual instrumentation using LABVIEW. **Essential electronics and Boolean algebra; Digital representation:** Binary, decimal, hexadecimal, conversion from binary to decimal and vice-versa.
Binary arithmetic: Addition, subtraction: 2's complement, multiplication and division, Boolean algebra: AND, OR, NOT, NAND, NOR, XOR Logic, truth table realization of logic in physical systems: switches-LEDs, cylinders. Fundamental identities, De Morgan's theorems and relationship with sets, simplification; **Electronics**

Fundamentals: Review of some semiconductor devices, concepts of digital and analog systems, digital output (DO) and input (DI), using switches, transistors, pneumatic devices etc. to realize DI and DO.

Operational Amplifiers: Principles, configurations, Inverting, summing, integrating and differentiating configurations, digital to analog conversion (DAC), the R-2R and summing Op-Amp circuit, analog to digital conversion (ADC), successive method, flash method, etc. programs for DI, DO, DA and AD for PC based plug in cards.

EEE 517: ELECTRICAL SERVICES DESIGN 3 UNITS

Basic electrical installation- distribution system regulation- IEE, NEC, Nigerian standards; cables- types, rating, wiring systems, protection of low voltage; installation; auxiliary electrical systems, fire alarm, telephone, elevator, circuits; proposals and contract document preparation, design of electrical installation, domestic, industrial, commercial, air conditioning; testing and certification, illumination. Telecommunication design and installation; telephone, PABX, cables, cabling, trucking, calculations etc. Computer networking; design, calculations, topology, cables, cabling, etc. Satellite and VSAT installation. Surge and lightning protections. Earthing; earth resistivity measurement, surge and lightning equipment selection and installation. Costing and preparation of BEME. Basic law of contract. Commissioning, environment impact assessment (EIA).

EEE 518: ADVANCED COMPUTER PROGRAMMING 3 UNITS

Element statistics: Distribution and experiments: Law of large numbers; Numerical iteration procedures. Review of Computer Hardware Architecture. The concept of Pipelining, Deadlock in computers. The computer bus. The Operating System: Types of operating systems, the operating system as a virtual machine and a resource manager. Reviews of FORTRAN and BASIC in Engineering. Programming in C language and Visual Basic Programming in Engineering; programme construction, editing, compilation and execution. The use of MATLAB and Simulink in Engineering applications.

EEE 521: OIL AND GAS INSTRUMENTATION 3 UNITS

Instruments used in drilling oil: wellheads, the oil rig system, drilling rigs, drilling motors, pipes, collars and bits. Instruments used in testing oils: Well logging instruments, drill stem testing instruments, proppants. Instruments used in extracting oil: Pump system steam injector. Instruments used in subsea drilling and production systems: Sonic equipment, mobile offshore drilling units (MODU), types of MODU, remotely operated vehicle (ROV), floating production, storage and offloading (FPSO) units, subsea control systems, wireless data acquisition systems. Flow station equipment and instruments.

EEE 526: ADVANCED CONTROL ENGINEERING 2 UNITS

Types of system nonlinearities, small perturbation methods, describing functions, phase plane analysis. Principles of sampled systems. Applications of Z-transforms. System performance and stability. State space analysis of control system. The transition matrix. On-line computer control. Derivation of digital control algorithms. Microprocessor application. Introduction to adaptive control: Hill climbing and model reference adaptive systems. Lyapunov's direct method of stability analysis. Lyapunov's functions. Stability regions for simple non-linear systems. Systems identification and testing methods. Applications of statistical correlations techniques.

EEE 523: PROCESS CONTROL 2 UNITS

Review of control systems, introduction to process control; processes. Basic terminologies in process control. Modelling of process control systems: Time and frequency domain system identification, adaptive control and robust control. Design of process control systems. Use of computers in process control: Analog and digital computer control models, application of fuzzy logic, neural networks, and genetic algorithm in process control.

EEE 524: ARTIFICIAL INTELLIGENCE AND ROBOTICS 2 UNITS

An introductory description of the major subjects and directions of research in AI programming techniques, basic problem solving techniques, knowledge acquisition and representation, AI languages (LISP and PROLOG), machine learning, natural language understanding,

knowledge-based and expert systems, computer vision, robotics, relationship of AI to software engineering and database methodology. Some impact of AI and Robotics.

EEE 525: MECHATRONICS II 1 UNIT

Programmable logic controller: basic structure, specifications programming of PLC's, importance of Timers, counters, maker relays, analog comparators in PLC programming:

Sensors and actuators: Strain guage, resistive potentiometers, tactile and force sensors, tachometers, LVDT, Piezo electric accelerometer, Hall

effect sensor, optical encoder, resolver, inductosyn, pneumatic and hydraulic actuators, stepper motor, AC motor.

Control System: Mathematical modeling of physical systems equations, controllability and observability, pole placement, PID controller, control of hydraulic, pneumatic, mechanical and electrical systems

Integration and case studies: Integration of mechatronics component subsystems into complete mechatronics system applications to CNC machines and robotics

EEE 533: DIGITAL SIGNAL PROCESSING 2 UNITS

Overview of signals, systems and signal processing; concepts of discrete-time signal processing and systems necessary for the design and analysis of advanced signal processing technology. Types and selection of ADC/DAC, sampling theorem, aliasing, quantization, noise and coding. Analysis and application of discrete-time signals and systems in transform Z-domain: Z-transform, properties, transfer stability, causality and difference equations. Discrete Fourier analysis and FFT. Digital time signals and systems, DTFT and IDTFT. Digital filters definition and filters, structure and design, FIR and IIR filters. Software implementation of DSP algorithms. DSP microprocessors: architecture,

fixed point and floating point DSP; signal segmentation effect, DSP chips. Practical application of DSP in audio and video.

EEE 537: OPTOELECTRONICS 2 UNITS

The wave nature of light. Polarization, the principle of superposition, interference, diffraction. Black body radiation. Photoluminescence. The cathode ray tube. Light emitting diodes. Plasma displays, Liquid Crystal Displays, Numeric displays. LASERS. Radiation emission principles. Classes of lasers. Laser Applications, Photo-detectors. Fibre optical waveguides. Optical waveguides. Optical communication systems.

EEE 527: FINITE ELEMENT MODELING 2 UNITS

Covers the basics of finite element theory: finite elements for one-dimensional problems, finite elements for scalar field problems in two dimensions and finite elements for vector field problems in two dimensions and beams. Finite element code development using MATLAB.

MEE 525: INDUSTRIAL AUTOMATION 3 UNITS

Introduction: basic concept of automation, types of automation, feasibility etc;

Industrial Hydraulics: Introduction, basic concepts, hydraulic fluids, classification and properties of hydraulic fluids, contaminants in hydraulic system, control and cleanliness standards, fluid power generators, i.e.; gear, vane, piston pumps, linear and rotary actuators, direction control valve types, actuation methods, pressure control valves; pressure reducing valves, pressure relief valve, unloading valve, sequence valve, counterbalance valve, flow control valves simple and pressure compensated type; standard ISO symbols for hydraulic components; seals in hydraulic system, accumulators, hydraulic

hoses and tubing, design and analysis and hydraulic circuits, conventional as well as computer aided design.

Industrial Pneumatics: Introduction, Basic components, Source, storage and distribution, treatment of compressed air, linear and Rotary actuators, direction control valve types, actuation methods, pressure control valves, logic devices – twin pressure valve, shutter valve, time delay valve, Pneumatic circuit design and analysis, conventional as well as computer aided design.

Automatic Assembly System: development of automatic assembly process, Transfer devices – continuous, Intermittent, synchronous and asynchronous, Vibratory feeders – Mechanics, effect of frequency, acceleration, track angle, friction, load sensitivity, orientation of parts – active and passive devices, Mechanical feeders – computation and operational details, feed tracks, Escapement devices; product design for high-speed automatic assembly, examples of design modifications.

EEE 531: DIGITAL COMMUNICATION SYSTEMS 2 UNITS

Block diagram of digital communication system. Review of Analogue Communication; Telegraphy; Telephony; Codes. Digital Communication: Advantages of digital signals. Noise in digital systems. Filtering and equalization. Digital modulation techniques: ASK, FSK, QPSK, M-PSK, QAM, etc. Error detection and correction techniques, Encoders/decoders. Application of Digital communication; Information Theory; numbering systems; Elements of Digital communication. Wireless communication systems (from 1G to 4G), Wireless Sensor Networks. Data Communication: Networking and Networks (LAN, MAN, and WAN), INTERFACES; Protocols and standards in data communication, Internet Technology, Microwave Communication System Design.

EEE 532: COMMUNICATION SYSTEMS ENGINEERING 3 UNITS

Satellite Communication: Introduction. Kepler's Laws. Orbit. Power systems. Frequency plans and polarization. Transponders. Satellite Earth-link. satellite link budget. INTELSAT VI. Regional satellite communication systems.

Fiber-Optic Communication: Introduction. Principle of Light Transmission in a fiber, losses in fibers, dispersion, light sources for fiber optics, fiber optic communication link. Applications.

Radar and its applications. Radar: Radar Equation. Radar range, minimum detectable signals. CW, Doppler, moving-target indication, laser radar. Radar transmitters, receivers and antennas. Propagation of radar waves.

Radio and Television Communication: Radio broadcast and reception systems. Television broadcast and reception systems; Composite video signal; Television camera, tubes, Broadcasting studio and studio equipment. Essentials of colour television; colour T.V display tubes. Flat panel TV systems.

EEE 538: ELECTRO ACOUSTICS 2 UNITS

The sound wave; propagation and characteristics. Basic principles of acoustics. Transducers. Microphones, loudspeakers: characteristics and applications. Electro acoustical and electromechanical analogies, acoustics of buildings; reverberation time, sound equalization, diffuse

and free-field considerations, noise absorption and insulations. Recording and reproduction systems and media. Introduction to ultrasonic applications.

EEE 539: INTRODUCTION TO VLSI TECHNOLOGY 2 UNITS

Principles of large scale nMos design: stick diagram; nMos transistors; switch and gate logic; programmable logic arrays; 2 phase dynamic design; finite state machines; scalable design rules; speed and power considerations; floor planning and communication; layout technique.

EEE 541: ELECTRIC POWER SYSTEMS ANALYSIS, PLANNING AND PROTECTION 3 UNITS

Modeling of Power Systems Components; load flow studies; representation of power systems; power system equation and analysis; load flow studies; load forecasting economic operation of power systems symmetrical components, symmetrical and unsymmetrical faults; detection; discrimination and fault clearance; power system stability, load growth and forecasting, introduction to power systems planning and operation using current and voltage level protection, time grading, principle of simple differential protection schemes. Reactors and Computer Application to Fault Analysis.

EEE 543: POWER ELECTRONICS AND DEVICES**3 UNITS**

Thyristor characteristics; ratings and protection, firing circuits; controlled rectifiers and commutation methods; Inverters, AC voltage controller; speed control motor; chopper circuits; oscillators; switching characteristics of diodes, transistors, thyristors, etc; analysis of diode circuit with reactive loads, analysis of circuits using transistors as switches, power control circuits, AC/DC converters, characteristics of switching transformers, power semi conductor device protection, examples of power electronic circuits, solar devices. Power translator and integrated circuits, welding and heating.

EEE 544: ELECTRICAL MACHINE DESIGN**2 UNITS**

Electric Machine Construction Materials; cables, magnetic cores; insulating materials their specifications; cooling, heating and temperature rise data/curves and ventilation/cooling curves; winding arrangements, flux flow and distribution in the cores for different winding; flux wave approximations and calculations; basic principle of electric machine design using machine output and dimensions; design of inductors, transformers, dc machines, induction motors, synchronous machines: determination of machine core shapes and dimensions, winding cable current rating, insulation and cooling specifications for given machine output rating.

EEE 546: POWER SYSTEMS DISTRIBUTION**2 UNITS**

Distribution system planning and automation; load characteristics; applications of distribution transformers; design of sub-transmission lines and distribution substations; design considerations of primary and secondary systems; voltage drop and power loss calculations; power factor capacitors and applications; protection; fault current calculations; types, characteristics and ratings of fuses, circuit breakers and lightning arrestors; coordinated protection design.

EEE 547: POWER SYSTEM OPTIMIZATION**2 UNITS**

Introduction to the formulation of optimization problems: problem variables, problem constraints, the objective function; unconstrained minimization: Powell's method of conjugate directions, Gradient methods, second order methods; constrained minimization problems: indirect methods by unconstrained minimization, penalty function approach; direct methods for constrained optimization; lagrange multiplier, Kuhn Tucker conditions; methods of feasible directions; linear (LP) and non-linear programming.

EEE 548: POWER SYSTEM COMMUNICATION AND CONTROL 2 UNITS

Review of transmission line theory; review of communication theory; high frequency communications on power lines; carrier systems and power line carrier applications; multiplexing, tele-metering; signal processing and data transmission; control of power generation; coltage and VAR controls, AVR and regulating transformers.

EEE 549: ADVANCED ELECTRICAL MACHINES AND DRIVES 3 UNITS

Review of fundamental laws, including Maxwell's equations; coupling concepts, voltage equations and equivalent circuits of induction and synchronous machines; symmetrical and unsymmetrical windings, distribution of fields and current loading, production of constant and pulsating torques, harmonic torques; Introduction generalized electrical characteristics of drives: basic concepts of electric drives; electrical characteristics of drives; speed control, motor selection and load diagrams.

EEE 542: SWITCHGEAR AND HIGH VOLTAGE ENGINEERING**2 UNITS**

Generation and measurement of high voltage and current; high voltage tests and measuring devices; breakdown theories for gaseous, liquid and solid dielectric impulse protection of substation; lightning phenomena and protection; travelling waves in transmission lines; Electric cables and condensers.

EEE 598: FINAL YEAR PROJECT AND SEMINAR

6 UNITS

Technical correspondence, technical proposals, field trip reports. Written and oral presentation of technical ideals reflected from final project: organization and use of audio-visuals aids. Each student will be required to prepare and present a seminar on an approved final project topic.

CHAPTER SIX

DEPARTMENT OF

MARINE ENGINEERING



MARINE ENGINEERING

LABORATORY

TITLE OF DEGREE PROGRAMME

This is the degree of Bachelors of Engineering (B.Eng.)

INTRODUCTION

Marine Engineering is involved in a special area of modern technology which makes it interesting and purposeful. For over a century, marine engineers play significant role in shipping industry and marine business. Their responsibilities include the provision, management, design, selection to do installation, operation and maintenance of engineering systems and associate equipment encountered in the shipping sector as well as marine engineering. To accomplish these goals, appreciable effort must be put into research, the area where theoretical work and laboratory experiments are used to seek understanding of various physical phenomena or to investigate new engineering concepts.

Because of rapidly changing technology, the education of a marine engineer must provide him with a sound base for working in fields which perhaps may not exist at the time of his graduation. For this reason, an undergraduate curriculum in marine engineering combines a broad training in basic disciplines with both theoretical and experimental project-oriented work

The marine engineering curriculum at FUPRE is designed to provide a comprehensive background in the main areas of mechanical and marine engineering during the first three years of study. In the last or senior year, the students devote a portion of their time to one of the options in ship power plant engineering, naval architecture and ship building engineering, and off shore engineering. At the same time, however, students take various courses both in technical subject and humanities, thereby ensuring that they receive a well-balanced

education. A senior design project enables each student to develop both his creativity and individual abilities. The possible topics over a wide field of subjects such as the application of solar energy, vibration studies, aerodynamics, propulsion, refrigeration, air conditioning, control, fluid power engineering and manufacturing science in shipping and marine industry. These topics prepare students both for entering shipping and marine industrial establishments directly and after graduation or for enrollment in graduate studies. The marine engineering program is evaluated by NUC every five years and the marine engineering curriculum is revised according to NUC recommendations.

VISION

To be a world reputed Marine Engineering Department graduate education and basic and applied research.

MISSION

To provide world-class marine engineering education the Federal Republic of Nigeria and the global regions. The graduates of the Department will be at the forefront of establishing, advancing, and expanding and indigenous knowledge base, which can be solidly relied upon for accepting future challenges, providing proper directions for growth in shipping and marine industry, and furnishing reliable solutions to engineering problems.

GOALS

- o To be preeminent in development and providing the highest quality undergraduate learning environment in Marine Engineering education.

To be a word reputed marine engineering programme in graduate education, and basic and applied research

- o To be preeminent on international level for academic, basic and applied research.

To be a preeminent and learning programme for supporting the technology advancement and economic growth of the

local, national and global area industry.

To be a part of a leading programme in human resource development and effective and efficient infrastructure utilization.

ADMISSION REQUIREMENT

To be eligible for admission into the degree programme, all applicants must satisfy the minimum entrance requirements stipulated in the UTME Regulations. That is, all applicants must possess a minimum of five (5) credit passes in either WAEC or NECO ordinary level English, Mathematics, Physics and Chemistry examinations, and any one of the following subject: Further Mathematics, Biology, agricultural Science and Technical Drawing, Economics, Geography and Fine and Applied Art. In addition, applicants must obtain the minimum cut-off points in UTME and PUTME (or equivalent) for the degree programme in the same cluster of five subjects.

STAFF PROFILE

DEPARTMENT OF MARINE ENGINEERING STAFF LIST

S/N	NAME OF STAFF	CADRE	QUALIFICATION	SPECIALIZATION	APPOINTMENT
1	NWAOHA, Thaddeus Chidiebere	Reader	PhD; M.Eng; B.Eng	Marine & Offshore Engineering	Permanent
2	Jasper Agbakwuru	Senior Lecturer	Ph.D, M,Sc B. Eng MNSE COREN	Offshore System Design	Permanent
3	Daniel Tamunodukobi-pi	Senior Lecturer	Ph.D, M,Sc B. Eng MNSE COREN	Ship Power Plant	Adjunct
4	ABAM, Joshua Tamunokpere	Lecturer I	M.Eng; B. Tech COREN	Offshore & Ocean Technology	Permanent
5	OMBOR, Pereowei Garrick	Lecturer I	M.Eng; B.Tech MNSE COREN	Marine & Environmental Engineering	Permanent
6	Idubor F. Ifeanyi	Lecturer I	M.Eng; B.Tech MNSE COREN		Permanent
7	Oshundario Mushafau	Technologist I	HND		Permanent
8	Okogie Winifred	A.R	B. Sc		Permanent
9	Augustine Philomena Ehinomen	A.R	B. Sc		Permanent

UNDERGRADUATE COURSE STRUCTURE FOR 200-500 LEVELS

FIRST SEMESTER							
COURSE CODE	COURSE TITLE	L	T	P	CREDIT UNIT	STATUS	
EEE 211	Basic Electrical Engineering I	2	-	-	2	C	
GET 211	Engineering Mathematics I	2	1	-	3	C	
GET 212	Engineering -in- Society	1	1	-	2	C	
GET 219	Engineering Laboratory I	-	-	9	2	C	

MEE 211	Engineering Drawing I	-	-	3	2	C
MEE 212	Engineering Mechanics I	2	-	-	2	C
MEE 213	Basic Manufacturing Technology	2	-	-	2	C
MEE 214	Engineering Materials	2	-	-	2	C
MEE 215	Fluid Mechanics I	2	-	-	2	C
MEE 216	Basic Thermodynamics	2	-	-	2	C
PEE 211	Introduction to oil and gas industry	1	-	-	1	C
TOTAL CREDIT UNITS					22	

SECOND SEMESTER						
COURSE CODE	COURSE TITLE	L	T	P	CREDIT UNIT	STATUS
CVE 221	Basic Civil Engineering	2	-	-	2	C
EEE 221	Basic Electrical Engineering II	2	-	-	2	C
GET 221	Engineering Mathematics II	2	1	-	3	C
EEE 222	Information Technology in Engineering	2	1	-	2	C
GET 229	Engineering Laboratory II	-	-	6	2	C
MEE 221	Engineering Drawing II	-	-	3	2	C
MEE 222	Engineering Mechanics II	2	-	-	2	C
GET 223	Basic Workshop Practice	-	-	3	1	C
MEE 224	Strength of Materials I	2	-	-	2	C
GET 299	Student Work Experience Programme (SWEP) I	-	-	-	2	C
TOTAL CREDIT UNITS					20	

300 LEVEL

FIRST SEMESTER						
COURSE CODE	COURSE TITLE	L	T	P	CREDIT UNIT	STATUS
GSE 311	Entrepreneurial Studies	2	-	-	2	C
GET 311	Engineering Mathematics III	2	1	-	3	C
MAR 311	Introduction to Oceanography	2	-	-	2	C
MAR 312	Marine Engineering Structural and Systems Drawing	2	-	-	2	C
MAR 313	Strength of Marine Structures	2	-	-	2	C
MAR 314	Marine Electrical Technology	2	-	-	2	C
MAR 319	Marine Engineering Laboratory I	-	-	9	2	C

MEE 312	Mechanics of Machines I	2	-	-	2	C
MEE 316	Thermodynamics & Heat Transfer	2	-	-	2	C
MEE 317	Basic Safety Engineering	1	-	-	1	C
TOTAL CREDIT UNITS					20	

SECOND SEMESTER						
COURSE CODE	COURSE TITLE	L	T	P	CREDIT UNIT	STATUS
GET 321	Engineering Mathematics IV	2	1	-	3	C
GET 322	Technical Report Writing and Seminar	1	-	-	1	C
MAR 321	Navigation and Meteorology	3	-	-	3	C
MAR 322	Marine Engineering Design	2	-	-	2	C
MAR 323	Marine Auxiliary Machineries	2	-	-	2	C
MAR 324	Marine Engineering Materials	2	-	-	2	C
MAR 325	Marine Corrosion Engineering	2	-	-	2	C
MAR 326	Marine Systems Instrumentation	2	-	-	2	C
MAR 329	Marine Engineering Laboratory II	-	-	9	2	C
GET 399	Student Work Experience Programme (SWEP) II	-	-	-	3	C
TOTAL CREDIT UNITS					22	

SECOND SEMESTER		
COURSE CODE	COURSE TITLE	CREDIT UNIT
GET 429	Student Industrial Work Experience Scheme (SIWES)	6
TOTAL CREDIT UNITS		6

A. SHIP POWER PLANTS ENGINEERING OPTION

FIRST SEMESTER						
COURSE CODE	COURSE TITLE	L	T	P	CREDIT UNIT	STATUS
EEE 516	Mechatronics I	2	-	3	2	C
GET 511	Engineering Law	2	-	-	2	C
MAR 511	Marine Hydraulics and Pneumatics	2	-	-	2	C
MAR 512	Marine & Offshore Engineering Modelling & Simulation	3	-	-	3	C
MAR 513	Marine Diesel Engine II	3	-	-	3	C
MAR 514	Ship Power Plant I	3	-	-	3	C
MAR 531	Ship Design and construction	3	-	-	3	C
MEE 512	Mechanical Vibration and Noise	2	-	-	2	C
MAR 598	Final Year Project & Seminar	-	-	9	0	C
TOTAL CREDIT UNITS					20	

SECOND SEMESTER						
COURSE CODE	COURSE TITLE	L	T	P	CREDIT UNIT	STATUS
EEE 525	Mechatronics II	1	-	3	1	C
GET 521	Engineering Management	2	-	-	2	C
MAR 521	Running and Maintenance of Ship Power Plant	2	-	-	2	C
MAR 522	Ship Propulsion Systems	2	-	-	2	C
MAR 523	Ship Automation	2	-	-	2	C
MAR 524	Marine Steam & Gas Turbine	3	-	-	3	C
MAR 525	Ship Power Plant II	2	-	-	2	C
MAR 598	Final Year Project & Seminar	-	-	9	6	C

TOTAL CREDIT UNITS	20	
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B. NAVAL ARCHITECTURE AND SHIP BUILDING ENGINEERING OPTION

FIRST SEMESTER						
COURSE CODE	COURSE TITLE	L	T	P	CREDIT UNIT	STATUS
EEE 516	Mechatronics I	2	-	3	2	C
GET 511	Engineering Law	2	-	-	2	C
MAR 598	Final Year Project & Seminar	-	-	9	0	C
MAR 511	Marine Hydraulics and Pneumatics	2	-	-	2	C
MAR 512	Marine & Offshore Engineering Modeling & Simulation	3	-	-	3	C
MAR 515	Naval Architecture II	3	-	-	3	C
MAR 516	Shipyards Technology I	3	-	-	3	C
MAR 531	Ship Design and construction	3	-	-	3	C
MEE 512	Mechanical Vibration and Noise	2	-	-	2	C
TOTAL CREDIT UNITS					20	

SECOND SEMESTER						
COURSE CODE	COURSE TITLE	L	T	P	CREDIT UNIT	STATUS
EEE 525	Mechatronics II	1	-	3	1	C
GET 521	Engineering Management	2	-	-	2	C
MAR 522	Ship Propulsion Systems	2	-	-	2	C
MAR 523	Ship Automation	2	-	-	2	C
MAR 528	Design & Construction of Offshore Structures	3	-	-	3	C
MAR 541	Design of Ship Hull Structures	2	-	-	2	C

MAR 542	Shipyards Technology II	2	-	-	2	C
MAR 598	Final Year Project & Seminar	-	-	9	6	C
TOTAL CREDIT UNITS					20	

C. OFFSHORE ENGINEERING OPTION

FIRST SEMESTER						
COURSE CODE	COURSE TITLE	L	T	P	CREDIT UNIT	STATUS
EEE 516	Mechatronics I	2	-	3	2	C
GET 511	Engineering Law	2	-	-	2	C
MAR 511	Marine Hydraulics and Pneumatics	2	-	-	2	C
MAR 512	Marine & Offshore Engineering Modeling & Simulation	3	-	-	3	C
MAR 517	Offshore Engineering II	3	-	-	3	C
MAR 518	Oil & Gas Drilling Technology	3	-	-	3	C
MAR 532	Port Equipment Engineering	3	-	-	3	C
MEE 512	Mechanical Vibration and Noise	2	-	-	2	C
MAR 598	Final Year Project & Seminar	0	-	9	6	C
TOTAL CREDIT UNITS					20	

SECOND SEMESTER						
COURSE CODE	COURSE TITLE	L	T	P	CREDIT UNIT	STATUS
EEE 525	Mechatronics II	1	-	3	1	C
GET 521	Engineering Management	2	-	-	2	C
MAR 526	Underwater Technology	3	-	-	3	C
MAR 527	Oil & Gas Production Technology	3	-	-	3	C
MAR 528	Design & Construction of Offshore Structures	3	-	-	3	C
MEE 521	Engineering Materials Selection	2	-	-	2	C
MAR 598	Final Year Project & Seminar	-	-	9	6	C
TOTAL CREDIT UNITS					20	

300 LEVEL

MAR 311: INTRODUCTION TO OCEANOGRAPHY 2 UNITS

Properties of sea water. Conservation equations. Equations of motion. Coriolis effect. Geostrophic current. Inertial current. World ocean and sea descriptions and characteristics. Planetary boundary layer flow. Wind-induced current. Bottom currents. Circulation. Tides. Global and local wind description. Mean wind. Wind gust. Wave forecast. Surface waves. Wave refraction. Non-linear waves. Breaking waves. Wave-current interaction.

MAR 312: MARINE ENGINEERING STRUCTURAL AND SYSTEMS DRAWING 2 UNITS

Introduction to Marine Engineering Drawing Types, Views, and Perspectives: Naval Architectural drawings, Piping and Instrumentation Drawing (P&ID), Electrical single lines and schematics, Electronic diagrams and schematics, Logic diagrams and prints, and Fabrication and construction.

Dimensions, limits, tolerance and detail information of joints, welding schemes and fitting design, such as piping holes, supports, reinforcements, etc of Marine Engineering Blueprints (machine or fabrication, structural or construction and architectural drawings): Machine Drawings of units and assemblies (such bearings, gears, valves, engine). Structural Drawings of units and assemblies (Bulkhead, Stringers, Frames, Girders and other ship's hull and offshore structures). Marine Engineering Systems P&IDs: Review of the basic drawing symbology, common standards, and conventions used on P&IDs, such as valve conditions and modes of failure. Drawing, reading and interpretation marine systems P&ID. Introduction to computers and computer graphics with AutoCAD.

MAR 313: STRENGTH OF MARINE STRUCTURES 2 UNITS

Environmental Loads (operating and Extreme Storm Conditions) on Marine Structures: Individual and combined Wind, Waves, Currents and Tides loads. 3-D stress and strain system; principal stresses and strain; stress-strain-temperature relations; Statically indeterminate systems. superposition method; moment-area method; strain energy method; theory of columns; Euler's column formula, Perry-Robertson Formula, Johnson-Ostenfeld Formula and empirical formula to predict Buckling/Collapse behaviour and Ultimate Strength of columns, beams, Cylindrical Shells, tubular members and plates under hydrostatic pressure, tension, compression, shear, bending and concentrated loads. Theories of failure; mechanics of creep, fatigue, ductile and brittle failure; Computational methods and software packages for analysis in strength of materials.

MAR 314: MARINE ELECTRICAL TECHNOLOGY 2 UNITS

Electrical installation on ships. Advantages and disadvantages of A.C. & D. C. systems on ships. Installation of generator sets on ships. Selection of D.C. and A.C. generators for use on ships with reference to its prime mover. Characteristics of A.C. generators. Rapid voltage response of A.C. Generators.

heat transfer by conduction through a spherical wall; steady-state conduction from fluid to fluid: heat transfer through plane and composite walls of a cylinder; critical diameter of insulation; heat transfer through a spherical wall, conduction with heat sources; transient conduction: the quenching of billets, numerical solution of unsteady one-dimensional conduction, two-dimensional conduction.

MEE 317: BASIC SAFETY ENGINEERING 1 UNIT

Principles of general safety and safety education; home safety, safe working practices; electrical safety; mechanical hazards; chemical hazards; environmental hazards; safety in hazardous area; industrial safety and analysis; fire safety, personal protection and fire arm safety; Road traffic and pedestrian safety; Occupational safety; Natural and man-made disasters; Health assurance.

MAR 321: NAVIGATION AND METEOROLOGY 3 UNITS

Introduction to seaman's skill. Ship nomenclature. Ship Equipment: deck gear and machinery. Hold ceiling, bulk head. Cargo protection. Anchor arrangements. Mooring and towing arrangements. Small boat handling with oars or engine. Mooring, anchoring, lowering and lifting of life boats. Use of life saving equipment. First Aid, Personal survival. Merchant ship departmental organization and station bills. Bridge equipment. Navigational Aids. Signalling and Communications. International convention. Weather: types, impact and predication. Climatology. Meteorological equipment and application in navigation. Marine ecology. Practical Laboratory work: Seamanship practice.

MAR 322: MARINE ENGINEERING DESIGN 2 UNITS

Design Concepts: Design and design process; creativity and creative process in design; concept of optimum in design; methods of research for best solution; material selection; use of Marine Engineering handbooks, codes, standards and systematic series datasheet of

maritime organizations, and other Regulatory and Classification societies such as DnV, USGS, API, Lloyds Registrar, ABS etc; detailed, assembly and working drawings; final technical documentation; analytical and experimental verification; feedback in design process; application of concepts to particular design. Force Systems and Stresses in Design: Review of strength of materials; theory of failure and factor of safety; stress concentration; fatigue strength and factors affecting fatigue strength; component design procedure.

Marine Structures and Systems Components Design: Stiffening Rings, Buoyancy tanks; Joints of offshore Structure Jackets; Hydrofoil, Rudder, Propeller; boat hullforms and scantling, Marine Boilers etc; computer algorithms, programs and packages used for design of Marine Structures and Systems components.

Design Projects: students will be required to carry out projects involving the use of computer and manual drafting in the design of marine structures and components to fulfil given specification; selection of appropriate materials for components and calculation of their sizes; making of appropriate layout, detailed drawings and Bill of Engineering Materials and Evaluations (BEME).

MAR 323: MARINE AUXILIARY MACHINERIES 2 UNITS

Introduction to marine engineering; types of marine power plants; introduction to marine auxiliary engines; transmission of power through propulsion systems; thrust bearing; shafting; shaft bearing; stern tube; propeller; different types of pumps, displacement and rotodynamic, construction, performance, characteristics; heat exchangers, types and construction, operation and temperature control; central cooling systems; pumping systems; cooling systems; ballast system, bilge system; pipe fitting; types of valve; deck machinery; watch keeping duties; Steering gear; bow thrusters; stabilizer

MAR 324: MARINE ENGINEERING MATERIALS 2 UNITS

Metals and principles of alloy theory; Structural phases: their formation and transition; Principles and applications of phase diagram;

Mechanism of phase changes; Defects in solids, mechanical behaviour of materials; Heat treatment; Materials for Offshore Applications, Weldability and performance of high strength steels used in offshore environment.

MAR 325: MARINE CORROSION ENGINEERING 2 UNITS

Fundamentals of Corrosion: Principles of Aqueous Corrosion, Corrosion Kinetics, High Temperature Oxidation Corrosion. Types of corrosions Offshore Corrosion: Microbial Corrosion, H₂S Corrosion, Hydrogen Embrittlement, Corrosion fatigue, CO₂ Corrosion Offshore Corrosion control: Stainless Steel, Inhibitors, Cathodic protection, overview of corrosion offshore, Corrosion Monitoring and Service Failure, corrosion analysis and mathematical modeling.

MAR 326: MARINE SYSTEMS INSTRUMENTATION 2 UNITS

Measurement principles and basic definitions. Standards. Accuracy and error analysis. Measurement statistics. Marine engineering instrument systems: Giro/GPS technologies in marine engineering, Acoustic underwater systems: Echo sounder, ut meters, side scanners etc. Descriptions of different forms of electromagnetic tools in marine engineering: Eddy current tools, Magnetic flux leak tools. Magnetometers. Typical devices for measuring quantities such as temperature, pressure, flow, size, displacement, velocity, acceleration, force power, torque, stresses and strain, salinity measurement system. Dynamics of measurement, data presentation and curve fitting.

MAR 329: MARINE ENGINEERING LABORATORY II 2 UNITS

Materials Production and Manufacturing Processes, Heat Transfer, Marine Systems Instrumentation. Destructive and non-destructive testing on steel joint and other alloys of steel in a wide range of environment. Analysis of samples from marine systems, including bilge, ballast, oil, stern tube systems and fuel tanks, to assess the risk of corrosion, etc. Marine environment simulation. Failure examinations of both ferrous and non-ferrous alloys from a wide variety of service environments. All testing is conducted in synthetic seawater under electrochemical control.

400 LEVEL**MAR 411: MARINE AND OFFSHORE SAFETY ANALYSIS 3 UNITS**

Introduction to safety and risk; risk and safety regulations in marine engineering; hazard identification techniques; consequence analysis; safety and risk evaluation; human factors and safety management; risk reduction and criteria; Safety based decision analysis; marine and offshore case studies and maritime law: IMO and Local Conventions and Regulations: MARPOL, SOLAS etc. Ship survey.

MAR 412: MARINE DIESEL ENGINES I 2 UNITS

Theoretical and Actual cycles. Classification of internal combustion engine. Construction details, scavenging, supercharging and turbo charging, turbo charger. Marine fuels and fuel injection systems; fuel injectors and fuel pumps. Combustion and combustion calculations. Dual fuel systems; fuel oil and injection systems for better engine performance, improving the total diesel propulsion plant efficiency, Diesel engine knocking, performance characteristics, indicator diagrams, efficiency and heat balance analysis and calculations. Production approaches of reducing the specific fuel consumption of main diesel engines, improving engine thermal efficiency. Engine rating and practical operation of propulsion machinery. Actual systems of training ship such as cooling lubricating, fuel starting and reversing systems of main engines. Main and Auxiliary engine preparation, starting, condition monitoring, normal/stopping procedures, overload and maneuvering operations, minimum speed operations in specific conditions. Practical laboratory work

MAR 413: OFFSHORE ENGINEERING I 2 UNITS

Geological properties of ocean floor, offshore prospecting; winds, waves, tides and current; history and development of offshore industry; types of offshore structures and vehicles, their performance, capabilities and limitations; fixed structures; compliant structures;

mobile structures; semi-submersibles; support and supply vessels; sub-sea systems; general design of a jacket platform; oil and gas drilling and production technology; safety aspect of offshore installation.

MAR 414: NAVAL ARCHITECTURE I 2 UNITS

Function of a ship; ship types: Principal terms; Layout and profile of ships; Ship body lines design and drawing. ship calculations involving areas, volumes, moments, displacement, TPC, Form coefficients and Bonjean curves, centre of gravity, Buoyancy, Stability; transverse and dynamical inclining experiment, calculation involving GZ, GM and BM: Longitudinal Stability Trim; change in trim and draughts; Free Surface effects. Statutory Regulations; Classification societies requirements; IMO Regulations; Practical work: Drawing and Laboratory.

MAR 415: MARINE FUEL TECHNOLOGY 2 UNITS

Fuel oil physical and chemical properties. Introduction to fuel cell technology. Fuel oil testing, storage: treatment of fuel for contaminants including microbiological infection, mixing etc, bunkering: shore side and shipboard sampling and testing, combustion of fuel-air for combustion. compression pressure ratio and its effect on engines, NOX and SOX Control in exhaust emission.

MAR 416: HYDRODYNAMICS 2 UNITS

Motion of Viscous Fluid: Viscous fluid flow Properties such as velocity vector, gravitation and body external forces and stresses. Conservation of mass and momentum. Transport Theorem, continuity equation, Euler's equation, Simplified forms and exact solutions of Navier-Stokes Equation. Boundary Conditions - Plane Couette and Poiseuille Flows. Unsteady motion of a flat plate. Laminar and Turbulent Boundary Layer Theory; Steady flow past a flat plate, steady 2D flow

Motion of Inviscid Fluid: Irrotational flows, Velocity Potential, Bernoulli Integral, Boundary Conditions, simple potential flows and stream functions

Hydrodynamics of Pressure Forces; Forces and moments acting on stationary and moving bodies due to dynamic pressure of fluids. Add

mass Coefficient

Lifting Surfaces (Propeller, Wings, Hydrofoil, Rudder): 2D flow past lifting surfaces. 2D Hydrofoil Theory, Sources and Vortex Distributions, Lift and Drag force, Simple Foil Shapes. 3D Planar lifting surfaces, 3D Vortices, Induced Drag, Lifting Line Theory. Cavitation.

Wave Systems: Free surface conditions, Analysis of Plane Progressive Wave System. 2D and 3D Ship Waves; Waves generated by moving ships and wave resistance.

MAR 419: MARINE ENGINEERING LABORATORY III 2 UNITS

Laboratory experiments in Principles of Air Conditioning and Refrigeration, Vibration and Noise, Marine Diesel Engines(dismantling and coupling of marine diesel engine), Naval Architecture (ship/offshore structures and design), Marine Propulsion (Engine room simulation) experiments.

**MEE 416: PRINCIPLES OF AIR CONDITIONING & REFRIGERATION
2 UNITS**

Refrigeration: Production of low temperatures; Application of the second law; Thermodynamics of vapour compression: vapour compression cycle, Pressure-Enthalpy diagram and analysis, standard rating cycle and effect of operating conditions, actual compression cycle. Refrigerants: designation, selection and requirements, secondary refrigerants, binary mixture; Introduction to multi-pressure systems; Vapour absorption systems; Ejection-compression system. Air conditioning: Properties of moist; psychrometric properties, psychrometric chart; Psychrometry of air-conditioning processes; Psychrometric processes in air-conditioning equipment; Simple air-conditioning systems and state and mass rate of supply air; Summer and winter air-conditioning; Design conditions; Introduction to ventilation; Aspects of design and application of air-conditioning and refrigerating systems; Microprocessor in system controls; Computer-aided system design and analysis.

500 LEVEL**EEE 516: MECHATRONICS I****2 UNITS**

Introduction: Mechatronics: What and Why? Mechatronic system design, sensors and transducers for displacement, proximity, velocity, force, pressure temperature measurement; Microprocessors – Introduction, structure micro-controllers, application programmable logic controllers – basic structure, specifications programming of PLC's, importance of Timers, Counters, marker relays, analog comparators in PLC programming; Introduction to Data Acquisition and virtual instrumentation using LABVIEW.

Essential electronics and Boolean algebra

Digital representation: Binary, decimal, hexadecimal, conversion from binary to decimal and vice-versa.

Binary arithmetic: Addition, subtraction: 2's complement, multiplication and division, Boolean algebra: AND, OR, NOT, NAND, NOR, XOR logic, truth table, realization of logic in physical systems: switches-LEDs, cylinders. Fundamental identities, De Morgan's theorems and relationship with sets, simplification

Electronics fundamentals: Review of some semiconductor devices, concepts of digital and analog systems, digital output (DO) and input (DI), using switches, transistors, pneumatic devices, etc. to realize DI & DO

MAR 511: MARINE HYDRAULICS AND PNEUMATICS**2 UNITS**

Fluid and gas properties; Air generation and distribution; Definition and flow characteristics; Control components: Valves and valve selection; Actuation and control valves; Hydraulic and pneumatic circuit design and analysis; Safety requirements for hydraulic and pneumatic systems; Hydraulic and pneumatic application in ship power plant and ROV; pumps and motors; Hydraulic and pneumatic system closed-loop computer controlled positioning experiment and case study.

MAR 512: MARINE AND OFFSHORE ENGINEERING MODELLING & SIMULATION 3 UNITS

Introduction to geometric main dimensions of ship hull form and platform rigs; drawing and fairing of ship lines; lines plans for different ship types; different types of bows and stern; ship form; space allocations and general arrangements GA; Mid-ship section; shell expansion drawing; airfoils and their marine applications; airfoil drawing; applications to rudders and ducts; propeller geometry; propeller drawings; introduction to engine room simulator; simulation of main engines and ship auxiliary systems; simulation of electric power plants. Practical Work using Matlab and other ship design software

MAR 513: MARINE DIESEL ENGINES II 3 UNITS

Review of marine diesel engine constructional features. The training machinery installation. Design of diesel engine cooling and fuel injection systems. Combustion chamber analysis and design. Vibration: simple systems, torsional, multi-cylinder crankshaft system, balancing and dampers. Introduction to exhaust system analysis and design. Energy utilization onboard ships, exhaust emission and control. Crankcase explosion, scavenge fire. Main diesel engine propulsion system evaluation using the diesel engine combustion performance analyzer, engine troubleshooting study and analysis. Practical Laboratory work

MAR 514: SHIP POWER PLANT I 3 UNITS

Power plants for special ships: Fishing vessels, tugs/pushers, tankers and passenger vessels. Flow resistance in Marine Auxiliary system pipes, valves and fittings. Pump performance and efficiency curves, velocity triangle, head, priming and cavitations. Compressor performance and efficiency curves. Marine blower performance and efficiency analysis/curves. Marine steam boilers. Principles of operation, classification, heat transfer in water tube, auxiliary, donkey and forced circulation boilers, controlled superheat and reheat boiler; components of a boiler, control, corrosion, boiler, materials, instrumentation and

automatic control of boilers. Application of boilers on ships. Boiler survey and classification society rule. Waste heat recovery systems. Practical Laboratory work

MAR 531: SHIP DESIGN AND CONSTRUCTION 3 UNITS

Basic concepts in ship design: Rules based on design principles, classification societies rules and regulations, ship design processes; Introduction: classification of ships: Functions, cargo type; Propulsion system; Characteristics of various types of ships; Structural arrangement; framing systems; functions of ship structural components double bottom, single bottom, shell plating, frames, Decks, Bulkheads, Pillars Girders, Hatch Coatings, machinery Casings, superstructures Deck houses, foundation laws and stern structures, Bossings and struts, Bilge keels and fenders, Hull assemble on shipway, shipway types and launching methods, shipway arrangements; Surface preparation and painting; corrosion prevention; superstructure outfitting arrangements; inspection, tests, and trials

MEE 512: MECHANICAL VIBRATION AND NOISE 2 UNITS

The general nature of free, forced and self-excited vibration; lumped one and two degree-of-linear systems; free motion, natural mode and viscous damping; Electrical analogy; forces transmitted to support; transmissibility, energy inputs and absorption; elements of the analysis of multi-body and distributed-mass linear systems; Raleigh's principle, Holzer's method and application; torsional vibration, flexural vibration of beams, whirling of a single disc on a shaft; whirling of shafts; introduction to transient vibration theory; vibration measuring instruments; vibration and noise control; computer-aided vibration and noise analysis and control.

EEE 525: MECHATRONICS II 1 UNIT

Microprocessor, Computers and Embedded systems: Introduction to the 8085 (8-bit microprocessor) and micro controller: Architecture,

programming, I/O, computer interfacing, programmable logic controller basics.

Sensors and actuators: Strain gauge, resistive potentiometers, tactile and force sensors, tachometers, LVDT, Piezo electric accelerometer, Hall effect sensor, optical encoder, resolver, inductosyn, pneumatic and hydraulic actuators, stepper motor, DC motor, AC motor.

Control Systems: Mathematical modelling of physical systems, system equations, controllability and observability, pole placement, PID controller, control of hydraulic, pneumatic, mechanical and electrical systems.

Integration and Case Studies: Integration of mechatronics component subsystems into complete mechatronics system applications to CNC machines and robotics.

MAR 521: RUNNING AND MAINTENANCE OF SHIP POWER PLANTS 2 UNITS

Running, maintenance and repairs of main and auxiliary diesel engines operations, General safety in machinery spaces. Inspection, Fault detection, troubleshooting, overhauling, dismantling, measurements, checking, disassembly and assembly. Defects, wear and damage, replacement of parts, bolt tightening. Repair methods. Maintenance Policies and Systems, Reliability Centred Maintenance of ship power plants. Condition monitoring and fault diagnosis expert system of a marine diesel engine. Testing of injectors, fuel pumps and valves. Adjustments and Overhauling of turbo chargers. Watch keeping. Practical Workshop.

MAR 522: SHIP PROPULSION SYSTEMS 2 UNITS

Fundamentals of ship propulsion; Resistance of ship; components of resistance; the effect of hull form and water path. Resistance in restricted water, resistance of small, fast ships; Methods of ship resistance calculations, model tests; laws of comparison; Propulsion devices. Geometry of screw propeller. Momentum theory of the screw. Axial and tangential losses. The propulsion coefficients.

The influence of after body on wave distribution. Propeller model tests and laws of comparison. Systematic screw-series. Hydrodynamic characteristics of screw propellers. Cavitation. Design of screw propellers. Performance curves. The screw propellers performance in different load conditions. Controllable pitch propellers. Calculations, design and drawing of screw propeller. Performance of propellers, graphical presentation of propeller performance.

Main engine-propeller-Hull matching involving engine layout and load diagrams.

Practical Laboratory work

MAR 523: SHIP AUTOMATION 2 UNITS

Introduction; definitions; regulation and automatic control; remote control; control systems: open-loop and close-loop, components, sensors, measuring instruments, controllers, correctors and actuators; controller actions; digital systems; time delays and system lags; type of control medium; mathematical model of control systems; response of control system to step, ramp and sine inputs; automatic control of diesel engine; speed governors; alarm and protective systems; steam boiler combustion control; boiler water level control: single two and three elements systems; data logging; centralized control; bridge control; control system of tankers.

MAR 524: MARINE STEAM AND GAS TURBINE 3 UNITS

Principles of operation and classification; Rankine Cycle; Reheat cycle; Regenerative cycle; Reheat/Regenerative cycle; cycle efficiencies; theory of steam expansion in cascade; gas Turbine, principles of operation and classification; Brayton cycle; Heat exchange cycle; Reheat cycle; Intercooler cycle; Intercooler/Reheat/Heat exchanger cycle; cycle efficiencies; combined steam and gas turbine cycles; turbo machinery theory: expansion of fluids in nozzles; expansion process in turbine stator blades; work done in turbine rotors; velocity distribution across compressor and turbine; pressure, velocity and pressure – velocity

compounding; steam turbine construction: governors, safety devices, glands, couplings, astern turbine, blades, rotors, blade fixing, seals, casings, condensers; gas turbine construction; rotors compressors blades, Intakes, combustors, turbines, exhausts.

MAR 525: SHIP POWER PLANT II 2 UNITS

Rules and Regulations guiding the design of ship power plants: Lloyds register rules and regulation; American Bureau of Shipping rules and regulations. Environmental Protection requirements. Design of Power Plant systems: Fuel oil systems, seawater cooling systems, lubricating oil systems, compressed air systems, steam systems, exhaust gas systems, fresh water systems, automatic control and alarm system. Modern Power Plant efficiency, enhancement and analysis energy balance analysis, energy balance diagram, flow diagrams of various types of power plants, overall efficiency determination. Comparison of power plant types. Selection of main engines. Graphical presentation of engine performance.

MAR 515: NAVAL ARCHITECTURE II 3 UNITS

Ship body line design and calculation: ship body plan drawing, Bonjean diagram and hydrostatic curves calculations and plating; ship stability: calculation and plotting of cross curves of stability by conventional and computer methods; ship subdivision, intact and damaged stability: calculation and plotting of floodable length curves; Ships rolling; the sea and ship motion. SOLAS convention. End and side launching of a ship; seaworthiness of a ship; practical work: laboratory tests for stability.

MAR 516: SHIPYARD TECHNOLOGY 3 UNITS

Shipyards layout; planning and scheduling of production; shipyard management; hull materials; materials storage; hull material fabrication; lofting steel fabrication processes; prefabrication of erection units; cranes and transportation devices; welding and welding machines: inspection; measurements methods and instruments: classification society requirements.

MAR 531: SHIP DESIGN AND CONSTRUCTION 3 UNITS

Basic concepts in ship design: Rules based on design principles, classification societies rules and regulations, ship design processes; Introduction: classification of ships: Functions, cargo type; Propulsion system; Characteristics of various types of ships; Structural arrangement; framing systems; functions of ship structural components double bottom, single bottom, shell plating, frames, Decks, Bulkheads, Pillars Girders, Hatch Coatings, machinery Casings, superstructures Deck houses, foundation laws and stern structures, Bossings and struts, Bilge keels and fenders, Hull assemble on shipway, shipway types and launching methods, shipway arrangements; Surface preparation and painting; corrosion prevention; superstructure outfitting arrangements; inspection, tests, and trials

MAR 522: SHIP PROPULSION SYSTEMS 2 UNITS

Fundamentals of ship propulsion; Resistance of ship; components of resistance; the effect of hull form and water path. Resistance in restricted water, resistance of small, fast ships; Methods of ship resistance calculations, model tests; laws of comparison;

Propulsion devices. Geometry of screw propeller. Momentum theory of the screw. Axial and tangential losses. The propulsion coefficients. The influence of after body on wave distribution. Propeller model tests and laws of comparison. Systematic screw-series. Hydrodynamic characteristics of screw propellers. Cavitation. Design of screw propellers. Performance curves. The screw propellers performance in different load conditions. Controllable pitch propellers. Calculations, design and drawing of screw propeller. Performance of propellers, graphical presentation of propeller performance.

Main engine-propeller-Hull matching involving engine layout and load diagrams.

Practical Laboratory work

MAR 523: SHIP AUTOMATION 2 UNITS

Introduction; definitions; regulation and automatic control; remote control; control systems: open-loop and close-loop, components, sensors, measuring instruments, controllers, correctors and actuators;

controller actions; digital systems; time delays and system lags; type of control medium; mathematical model of control systems; response of control system to step, ramp and sine inputs; automatic control of diesel engine; speed governors; alarm and protective systems; steam boiler combustion control; boiler water level control: single two and three elements systems; data logging; centralized control; bridge control; control system of tankers.

MAR 528: DESIGN AND CONSTRUCTION OF OFFSHORE STRUCTURES 3 UNITS

Wave theories; wave loading and offshore structures; Morison equation; wave slamming; current forces; wind forces of offshore structures; wave spectra and random loading; structural design of the jacket structure; stresses in cylindrical members and joints; design of topside structures; construction materials; steel structures; concrete structures; fabrication of the jacket and topside structures; transportation, launching, lifting and upending operations; piling and installation operations; certifications and regulations.

MAR 541: DESIGN OF SHIP HULL STRUCTURES 2 UNITS

Loads acting on ship structure; Types of ship structures; Framing systems; Classification Rules; Function of ship structural components; Double bottom; Single bottom, shell plating; Frames; Decks; Bulkheads; Pillars; Girders; Hatch coamings; Machinery casings; Superstructures; Bossings and struts; Bilge keels and fenders; Strength: Longitudinal bending moment and shear forces in still water; Wave bending moment; Total bending moment; Hogging and sagging; Dynamics forces; Local stresses; Torsion; Function of ship structure; Girder section modules and stress; Deflection of ships; Transversal strength; Thermal effects; Local strength; Fatigue; Local vibrations; Reducing of hull vibration.

MAR 542: SHIPYARD TECHNOLOGY II 2 UNITS

Hull assembly on slipway; slipway types and launching methods; deflection of hull; cutting, welding and riveting; shipway arrangement; machinery installation; shafting and screw assembly; boilers and

auxiliary machines installation; deck equipment; masts, booms and cranes; steering gears; hatch covers; mooring arrangements; life saving equipment; container fitting; surface preparation and painting; corrosion prevention; superstructure outfitting; fire-fighting arrangements; inspection, tests and trials; classification society requirements and certificates; dry – cocking; hull cracks and crack-arresting methods.

MAR 517: OFFSHORE ENGINEERING II 3 UNITS

Introduction to offshore pipelines; route selection and site investigation; materials and fabrication: pipeline hydraulics; loads and design; stability; construction and installation; corrosion; operation, inspection and repair; codes and standards.

MAR 518: OIL AND GAS DRILLING TECHNOLOGY 3 UNITS

Drilling objectives; physical and mechanical properties of rocks; drilling methods, drilling equipment, main and auxiliary drilling tools, drilling bits, drilling string, bit-rotation mechanisms; Mud engineering, drilling fluids, directional drilling, drilling practices; casing and cementing operations; drilling complications; drilling economics.

MAR 532: PORT EQUIPMENT ENGINEERING 3 UNITS

Port and harbor facilities, marine terminals, construction shipyards, repair docks; general design considerations, design criteria, site selection and layout, facility type requirements, environmental conditions, material selection; operational and environmental loads; berthing loads and fender system design; Mooring loads and design principles; fixed structures, structure types and configurations, selection of optimum structure types, design features; Floating structures, types and applications, structural design, mooring system design; Inspection, maintenance and repair operations.

MAR 526: UNDERWATER TECHNOLOGY 3 UNITS

Survey of undersea activities in oceanography and offshore engineering – the tools of underwater operations, decompression chambers, diving apparatus, submarines, robotics and remotely operated vehicles – design criteria and applications – corrosion and cathodic protection – underwater inspection, maintenance and repair operations.

MAR 527: OIL AND GAS PRODUCTION TECHNOLOGY 3 UNITS

Physical properties of oil and gas; well completions, bottom hole completion techniques, well productivity; types of production systems, fixed plate forms, floating production, sub-sea systems; offshore pipelines; process plant, general layout and design, produced fluid systems, gas injection systems, separation facilities, oil and gas transfer, oil and gas flow metering, oily water processing; maintenance and safety aspects.

MEE 521: ENGINEERING MATERIALS SELECTION 2 UNITS

Design with Materials, Introductory case study; Materials data, databases and graphical representation of materials properties; Deriving material indices and basic materials selection; Checking and estimating materials data; Materials selection by successive application of property limits and indices; Materials Selection problems with multiple constraints and compound objectives, Penalty functions, Value

functions; Selection of material and shape; Shape factors, Structural sections and mechanical efficiency, Material indices that include shape, Material limits for shape factors, Microscopic and micro-structural shape factors; Materials processing and its influence on design, Process attributes, systematic process selection, Process selection diagrams, Process cost and cost modeling; Designing hybrid materials; Materials selection for sustainable and environmentally conscious design; Design Project Presentations.

MAR 598: FINAL YEAR PROJECT AND SEMINAR 6 UNITS

Final Year Project: Individual Final Year Research Projects, which could be in the areas of Ship Power Plant Engineering, Naval Architecture and Ship Building Engineering, and Offshore Engineering. In these areas, students are to undertake research projects involving design, construction and testing of components and systems in ship and marine environment; experimental and simulation studies; review, appraisal or evaluation of operations, and maintenance strategies and processes; and theoretical or feasibility studies. Emphasis should be placed on practical oriented projects involving experimental studies, and design, construction and testing.

Seminar: Students are to present two seminars derived from final year project work each in a semester.

CHAPTER SEVEN

DEPARTMENT OF MECHANICAL ENGINEERING



MECHANICAL ENGINEERING

LABORATORY

TITLE OF DEGREE PROGRAMME

This is the degree of Bachelors of Engineering (B.Eng.)

INTRODUCTION

Mechanical engineering is involved in every area of modern technology which makes it interesting and versatile. For over a century, mechanical engineers have been building engines to develop power, applying power for useful purposes by means of machines, using machines in transportation of people and things, and controlling environments and industrial processes. In addition to these traditional fictions, today's mechanical engineers develop new products, new manufacturing processes, which may include sophisticated machinery, and new materials to develop better and cheaper products; improve energy conversion processes to make power plant more efficient; control environmental living conditions by means of refrigeration and air-conditioning; develop alternative forms of energy; and devise new transportation systems and other systems beneficial to society. To accomplish these goals, appreciable effort must be put into research, the area where theoretical work and laboratory experiments are used to seek understanding of various physical phenomena or to investigate new engineering concepts.

Because of rapidly changing technology, the education of an engineer must provide him with a sound base for working in fields which perhaps may not exist at the time of his graduation. For this reason, an undergraduate curriculum in mechanical engineering combines a broad training in basic disciplines with both theoretical and experimental project-oriented work.

The mechanical engineering curriculum at FUPRE is designed to provide a comprehensive background in the main areas of mechanical engineering during the first three years of study. In the last or senior year, the students devote a portion of their time to one

of the options in applied mechanics and design, industrial and production engineering, thermo-fluid engineering, and materials and metallurgical engineering. At technical subjects and in humanities, thereby ensuring that project enables each subjects and in humanities, thereby ensuring that they received a well-balanced education. A senior design project enables each student to develop both his creativity and individual abilities. The possible topics cover a wide field of subjects such as the application of solar energy, vibration studies, aerodynamics, propulsion, refrigeration, air conditioning, control and fluid power engineering and malfunctioning systems. These topics prepare students both for entering industrial establishments directly and after graduation or for enrollment in graduate studies. The mechanical engineering program is evaluated by NUC every five years and the ME curriculum is revised according to NUC recommendations.

VISION

- o To be a world reputed mechanical Engineering Department in graduate education, and basic and applied research.
- o To be preeminent on international level for academic, basic, and applied research.
- o To be a preeminent and leading institution for supporting the technological advancement and economic growth of the local, national, and Global area industry.
- o To be a part of a leading university in human resource development, effective and efficient infrastructure utilization.

MISSION

To provide high quality education in mechanical engineering, conduction of world-class basic and applied research, address the evolving needs of industry and society, and support the development of more competitive and new industry in the Federal Republic of Nigeria.

GOALS

The objectives of the Mechanical Engineering Department program are summarized below;

- To produce graduates with adequate with adequate knowledge and skills that can:
 - o Work in both the private sector and the public sector of the economy.
 - o Initiate and carryout engineering design and studies
 - o Engage in the management of industrial production operations
 - o Pursue research and development activities
- Development and provision of special engineering education geared towards the achievement of national goals, industrialization and self reliance, with special interest in Oil and Gas Industries.
- Provision of training in the theory and practice of engineering.
- Early introduction of students to entrepreneurial education and training.
- Acquisition of practical industrial experience for students by partnering with local industries in the execution of the Students Industrial Work Experience Scheme (SIWES)

ADMISSION REQUIREMENT

To be eligible for admission into the degree programme, all applicants must satisfy the minimum entrance requirements stipulated in the UTME Regulations. That is, all applicants must possess a minimum of five (5) credit passes in either WAEC or NECO ordinary level English, Mathematics, Physics and Chemistry examinations, and any one of the following subject: Further Mathematics, Biology, agricultural Science and Technical Drawing, Economics, Geography and Fine and Applied Art. In addition, applicants must obtain the minimum cut-off points in UTME and PUTME (or equivalent) for the degree programme in the same cluster of five subjects.

7.7 STAFF PROFILE

ACADEMIC STAFF PROFILE

S/ N	NAME	SPECIALIZATION	QUALIFICATION	TENURE	RANK
1.	Engr. Prof I.C. Ajuwa	Materials and Metallurgy	M.Sc., PhD MNSE, COREN	Permanent	Professor
2.	Engr. Prof C.O Izelu	Material Design and Manufacturing	B. Eng., M.Sc. ,PhD, MNSE, COREN	Permanent	Professor
3.	Engr. Prof. J. Ovri	Materials and Metallurgy	B. Sc., M.Sc. , PhD	Sabbatical	Professor
4.	Dr. C.A. Ebiogwu	Materials and Metallurgy	B. Sc., M.Sc. , PhD	Temporary	Reader
5.	Engr. Dr. I. Emovon	Industrial Engineering	B.Eng., M.Eng., PhD MNSE, COREN	Permanent	Reader
6.	Engr. Dr. F. I. Ashiedu	Industrial/Engineering Design	B. Eng. M.Eng. PhD MNSE, COREN	Permanent	Reader
7.	Engr. Dr. C.O. Mgbemena	Material Design and Manufacturing	BEng. M.Eng. PhD MNSE, COREN	Permanent	Senior Lecturer
8.	Engr. Dr. O.B. Otanocha	Sustainable Production Systems, Advanced Manufacturing Technology, Artificial Intelligence and Enterprise Development	BEng. M.Eng. PhD MNSE, COREN	Permanent	Senior Lecturer
9.	Engr. Dr O.D. Samuel	Engineering Mechanics and Renewable Energy	B. Eng., M.Eng., PhD MNSE, COREN	Permanent	Senior Lecturer
10.	Engr. Dr. B.U. Oreko	Mechanical Design, Materials and Industrial Engineering	B.SC. M.Eng. PhD MNSE, COREN	Permanent	HOD/ Senior Lecturer
11.	Engr. Dr. M.O. Okwu	Industrial and Operational Research	B. Eng., M.Eng, PhD MNSE, COREN	Permanent	Senior Lecturer
12.	Engr. Dr. E. Emagbetere	Applied Mechanics and Mechanical Design	B. Eng. , M.Sc, PhD MNSE, COREN	Permanent	Senior Lecturer
13.	Engr. Dr. J.O Oyekale	Thermofluid, Applied Energy	B. Eng., M.Tech, PhD, MNSE, COREN	Permanent	Senior Lecturer
14.	Dr A.O. Odidi	Thermofluid, Vibration and Design	B. Eng. M.Eng. PhD	Contract	Lecturer I

15.	Engr. A.B. Edward	Design and Manufacturing	B.SC., M.Sc., MNSE, COREN	Permanent	Lecturer I
16.	Engr. E.B Agbro	Thermofluid	B. Eng. , M.Eng , MNSE, COREN	Permanent	Lecturer I
17.	Engr E.T. Boye	Thermofluid, Computational Fluid Dynamics and Applied Energy	HND, B. Eng., M.Eng MNSE COREN	Permanent	Lecturer I
18.	Engr. I.O. Adeyemi	Industrial and Production	B. Eng., M.Eng, MNSE COREN	Permanent	Lecturer I
19.	Mr. O.J. Oyejide	Industrial and Production	B. Eng., M.Eng	Permanent	Lecturer I
20.	Mr. O.L Agberegha	Industrial and Production	B. Eng., M.Eng	Permanent	Lecturer I
21.	Mr. P.A. Oghenekowho	Materials and Metallurgy	B. Eng., M.Eng	Permanent	Lecturer I
22.	Mrs. S. I. Oghenevwaire	Industrial and Production	B. Eng., M.Eng	Permanent	Lecturer I
23.	Mr. A. Akene	Industrial and Production	B. Eng., M.Eng	Permanent	Lecturer I

NON ACADEMIC STAFF

(i) Technical Staff (Workshops and Laboratories)

S/N	NAME	SPECIALIZATION	QUALIFICATION	RANK
1.	Engr F.A. Okoigun	Thermodynamics, Machine Shop	HND, PGD, NIMECHE, MNSE COREN	Assistant Chief Technologist
2.	Engr U.P. Anaidhuno	CAD/CAM, Mechatronics, Foundry	M.Eng, PGD, HND, COREN	Assistant Chief Technologist
3.	Mr. A.A Ajiboluwa, (Engn Tech)	Strength of Materials and Metallurgy	HND, MNATE, COREN	Assistant Chief Technologist
4.	Mr. M.U. Eki , (Engn Tech)	Refrigeration and Air-conditioning, Automotive, Mechanics of Machine	M.Sc, PGD, HND, MASSE, COREN MNIMECHE, MISPAN, MAUTOEI, MNATE, AMT,	Principal Technologist
5.	Mr. F. Maduiké (Engn Tech)	Welding and Fabrication, Mechatronics, Wood Work	HND, MNATE COREN	Principal Technologist
6.	Mr. L. E. David	Automotive, Mechanics of Machine, Autotronic	HND	Senior Technologist
7.	Mrs A.V. Omonigho	Fluid Mechanics, Autotronics	HND, MNATE	Senior Technologist
8.	Mr. J. Usidame	Welding and Fabrication, Machine tools	OND	Technical Officer
9.	Mr. D. Abudu	Welding and Fabrication, Machine tools	OND	Technical Officer

(ii) Administrative Staff

S/N	NAME	QUALIFICATION	RANK
1.	Mrs. P. E nukpere	BSc	Admin Officer
2.	Mrs. O. Adeyemi	BSc	Admin Officer

UNDERGRADUATE COURSE STRUCTURE FOR 200-500

200 LEVEL

FIRST SEMESTER							
COURSE CODE	COURSE TITLE	L	T	P	CREDIT UNIT	STATUS	
EEE 211	Basic Electrical Engineering I	2	-	-	2	C	
GET 211	Engineering Mathematics I	2	1	-	3	C	
GET 212	Engineer - in - Society	2	-	-	2	C	
GET 219	Engineering Laboratory I	-	-	9	2	C	
MEE 211	Engineering Drawing I	-	-	3	2	C	
MEE 212	Engineering Mechanics I	2	-	-	2	C	
MEE 213	Basic Manufacturing Technology	2	-	-	2	C	
MEE 214	Engineering Materials	2	-	-	2	C	
MEE 215	Fluid Mechanics	2	-	-	2	C	
MEE 216	Basic Thermodynamics	2	-	-	2	C	
PEE 211	Introduction to oil & gas industry	1	-	-	1	C	
TOTAL CREDIT UNITS					22		

T

SECOND SEMESTER						
COURSE CODE	COURSE TITLE	L	T	P	CREDIT UNIT	STATUS
CVE 221	Basic Civil Engineering	2	-	-	2	C
EEE 221	Basic Electrical Engineering II	2	-	-	2	C
GET 221	Engineering Mathematics II	2	1	-	3	C
EEE 222	Information Technology in Engineering	2	1	-	3	C
GET 229	Engineering Laboratory II	-	-	6	2	C
MEE 221	Engineering Drawing II	-	-	3	2	C
MEE 222	Engineering Mechanics II	2	-	-	2	C
GET 223	Basic Workshop Practice	-	-	3	1	C
MEE 224	Strength of Materials I	2	-	-	2	C
GET 299	Student Work Experience Programme (SWEP) II	-	-	-	2	C
TOTAL CREDIT UNITS					20	

FIRST SEMESTER						
COURSE CODE					CREDIT UNIT	
GSE 311	Entrepreneurial Studies	2	-	-	2	C
EEE 315	Electrical Machines I	2	-	-	2	C
GET 311	Engineering Mathematics III	2	1	-	3	C
MEE 311	Machine Drawing	-	-	3	1	C
MEE 312	Mechanics of Machines I	2	-	-	2	C
MEE 313	Manufacturing Technology I	2	-	-	2	C
MEE 314	Strength of Materials II	2	-	-	2	C
MEE 315	Fluid Mechanics II	2	-	-	2	C
MEE 316	Thermodynamics & Heat Transfer	2	-	-	2	C
MEE 317	Basic Safety Engineering	1	-	-	1	C
MEE 319	Mechanical Engineering Laboratory I	-	-	9	3	C
TOTAL CREDIT UNITS					24	

SECOND SEMESTER						
COURSE CODE	COURSE TITLE	L	T	P	CREDIT UNIT	STATUS
GET 321	Engineering Mathematics IV	2	1	-	3	C
GET 322	Technical Report Writing and Seminar	1	-	-	1	C
MEE 321	Mechanical Engineering design I	2	-	-	2	C
MEE 322	Mechanics of Machines II	2	-	-	2	C
MEE 323	Manufacturing Technology II	2	-	-	2	C
MEE 324	Metallurgy I	2	-	-	2	C
MEE 326	Heat Transfer	2	-	-	2	C
MEE 327	Mechanical Systems Instrumentation	2	-	-	2	C
MEE 329	Mechanical Engineering laboratory II	-	-	9	3	C
GET 399	Student Work Experience Programme (SWEP) II	-	-	-	3	C
TOTAL CREDIT UNITS					22	

FIRST SEMESTER						
COURSE CODE	COURSE TITLE	L	T	P	CREDIT UNIT	STATUS
GET 411	Engineering Mathematics V	2	1	-	3	C
MEE 411	Mechanical Engineering Design II	3	-	-	3	C
MEE 414	Metallurgy II	2	-	-	2	C
MEE 415	Turbomachinery	2	-	-	2	C
MEE 416	Principles of Air-conditioning & Refrigeration	2	-	-	2	C
MEE 417	Oil and Gas Industry Equipment Maintenance	2	-	3	3	C
MEE 418	Workshop Practice (Auto/R&A)	-	-	3	1	C
MEE 419	Mechanical Engineering Laboratory III	-	-	9	3	C

TOTAL CREDIT UNITS	19	
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SECOND SEMESTER		
COURSE TITLE	CREDIT UNIT	
Student Industrial Work Experience Scheme (SIWES)	6	
TOTAL CREDIT UNITS		6

500 LEVEL

(A) APPLIED MECHANICS AND DESIGN OPTION

FIRST SEMESTER						
COURSE CODE	COURSE TITLE	L	T	P	CREDIT UNIT	STATUS
EEE 516	Mechatronics I	2	-	3	2	C
GET 511	Engineering Law	2	-	-	2	C
MEE 511	Mechanical Engineering Design III	2	-	-	2	C
MEE 512	Mechanical Vibrations and Noise	2	-	-	2	C
MEE 513	Computer-Aided Design & Manufacture	1	-	6	3	C
MEE 514	Mathematical Modeling & Operations Research	2	-	-	2	C
MEE 515	Robotics: Mechanics & Control	2	-	-	2	C
MEE 531	Quality and Reliability Assurance	3	-	-	3	C
MEE 535	Building Services Engineering	3	-	-	3	C
TOTAL CREDIT UNITS					21	

SECOND SEMESTER						
CODE					UNIT	
EEE 525	Mechatronics II	1	-	3	1	C
GET 521	Engineering Management	2	-	-	2	C
MEE 521	Engineering Materials Selection	2	-	-	2	C
MEE 522	Control Systems Engineering	2	-	-	2	C
MEE 523	Technology Policy & Development	2	-	-	2	C
MEE 524	Theory of Elasticity and Plasticity	3	-	-	3	C
MEE 525	Industrial Automation	3	-	-	3	C
MEE 598	Final Year project and Seminar	-	-	9	6	C
TOTAL CREDIT UNITS					21	

(B) THERMO-FLUID ENGINEERING OPTION

FIRST SEMESTER						
COURSE CODE	COURSE TITLE	L	T	P	CREDIT UNIT	STATUS
EEE 516	Mechatronics I	2	-	3	2	C
GET 511	Engineering Law	2	-	-	2	C
MEE 511	Mechanical Engineering Design III	2	-	-	2	C
MEE 512	Mechanical Vibrations and Noise	2	-	-	2	C
MEE 513	Computer-Aided Design & Manufacture	1	-	6	3	C
MEE 514	Mathematical Modeling & Operations Research	2	-	-	2	C
MEE 516	Advanced Thermodynamics	3	-	-	3	C
MEE 532	Computational Transport Phenomena	3	-	-	3	C
MEE 536	Air Conditioning and refrigerating Engineering	3	-	-	3	C
TOTAL CREDIT UNITS					22	

SECOND SEMESTER						
COURSE CODE	COURSE TITLE	L	T	P	CREDIT UNIT	STATUS
EEE 525	Mechatronics II	1	-	3	1	C
GET 521	Engineering Management	2	-	-	2	C
MEE 521	Engineering Materials Selection	2	-	-	2	C
MEE 522	Control Systems Engineering	2	-	-	2	C
MEE 523	Technology Policy & Development	2	-	-	2	C
MEE 525	Industrial Automation	3	-	-	3	C
MEE 526	Power Plant Engineering	3	-	-	3	C
MEE 598	Final Year project and Seminar	-	-	9	6	C
TOTAL CREDIT UNITS					21	

© **INDUSTRIAL AND PRODUCTION ENGINEERING OPTION**

FIRST SEMESTER						
COURSE CODE	COURSE TITLE	L	T	P	CREDIT UNIT	STATUS
EEE 516	Mechatronics I	2	-	3	2	C
GET 511	Engineering Law	2	-	-	2	C
MEE 511	Mechanical Engineering Design III	2	-	-	2	C
MEE 512	Mechanical Vibrations and Noise	2	-	-	2	C
MEE 513	Computer-Aided Design & Manufacture	1	-	6	3	C
MEE 514	Mathematical Modeling & Operations Research	2	-	-	2	C
MEE 517	Industrial Engineering	2	-	-	2	C
MEE 533	Numerical Control of Machine Tools	3	-	-	3	C
MEE 537	Industrial Ventilation and Air Pollution Control Systems	3	-	-	3	C
					21	

SECOND SEMESTER						
COURSE CODE	COURSE TITLE	L	T	P	CREDIT UNIT	STATUS
EEE 525	Mechatronics II	1	-	-	1	C
GET 521	Engineering Management	2	-	-	2	C
MEE 521	Engineering Materials Selection	2	-	-	2	C
MEE 522	Control Systems Engineering	2	-	-	2	C
MEE 523	Technology Policy & Development	2	-	-	2	C
MEE 524	Theory Elasticity and Plasticity	3	-	-	3	C
MEE 527	Production Engineering	3	-	-	3	C
MEE 598	Final Year project and Seminar	-	-	9	6	C
TOTAL CREDIT UNITS					21	

(D) MATERIALS AND METALLURGICAL ENGINEERING OPTION

FIRST SEMESTER						
COURSE CODE	COURSE TITLE	L	T	P	CREDIT UNIT	STATUS
EEE 516	Mechatronics I	2	-	3	2	C
GET 511	Engineering Law	2	-	-	2	C
MEE 511	Mechanical Engineering Design III	2	-	-	2	C
MEE 512	Mechanical Vibrations and Noise	2	-	-	2	C
MEE 514	Mathematical Modeling & Operations Research	2	-	-	2	C
MEE 513	Computer-Aided Design & Manufacture	1	-	6	3	C
MEE 518	Fracture and Fatigue of Engineering Materials	2	-	-	2	C
MEE 534	Forming and Finishing Technology	3	-	-	3	C
MEE 538	Corrosion Control and Protection	3	-	-	3	C
TOTAL CREDIT UNITS					21	

SECOND SEMESTER						
COURSE CODE	COURSE TITLE	L	T	P	CREDIT UNIT	STATUS
EEE 525	Mechatronics II	1	-	3	2	C
GET 521	Engineering Management	2	-	-	2	C
MEE 521	Engineering Materials Selection	2	-	-	2	C
MEE 522	Control Systems Engineering	2	-	-	2	C
MEE 523	Technology Policy & Development	2	-	-	2	C
MEE 524	Theory of Elasticity and Plasticity	3	-	-	3	C
MEE 528	Steel Making Technology	3	-	-	3	C
MEE 598	Final Year project and Seminar	-	-	9	6	C
TOTAL CREDIT UNITS					22	

300 LEVEL

EEE 315: ELECTRICAL MACHINES I 2 UNITS

Electromagnetic Theory: field intensity, flux, magnetic circuits, inductor circuit; **Electromechanical conversion principles:** mechanical energy in basic electromechanical system, torque production, Generalized electrical machine; **Transformers:** Features, principle of operation, equivalent circuits, phasor diagram, regulation, efficiency, rating, three phase delta/star connections; **DC Machines:** Classification, principle of operation, operating characteristics, rating, efficiency, applications; **Induction Machines:** three phase and single phase induction motors, classification, theory and operation, equivalent circuits, phasor diagrams, operating characteristics and efficiency.

MEE 311: MACHINE DRAWING 1UNIT

Review of joints – permanent and separable, and shafting; problems in development of curved surfaces and intersections; working drawings of machine components; machine drawings of units and assemblies including bearings, gears, valves, engine details and other units and assemblies; fits, limits and tolerances and their specifications; interchangeability requirements of machine units and assemblies; introduction to computers and computer graphics with AutoCAD.

MEE 312: MECHANICS OF MACHINES I 2 UNITS

Concepts of mechanisms, linkages, kinematic pairs, kinematic chains and kinematic inversion; classification of mechanisms; dynamics of planar mechanisms; cams and cam systems; gears and geared systems; dynamics of reciprocating machines; static and dynamic balancing of machines; balancing of rotating and reciprocating masses; computer algorithms and programs for synthesis and analysis of machines and mechanisms; mechanism design projects.

MEE 313: MANUFACTURING TECHNOLOGY I 2 UNITS

Principles of transmission of motion and power; Basic workshop machine tools; Metal cutting and cutting tools; Theory and practice of bench work, turning, drilling, boring, shaping, planning, slotting, grinding, milling, gear cutting, press and presswork. Broaching and sawing; Erection and testing of machines tools; Advanced workshop exercises in metal cutting processes.

MEE 314: STRENGTH OF MATERIALS II 2 UNITS

3-D stress and strain system; principal stresses and strain; stress-strain-temperature relations; statically indeterminate systems; superposition method; moment-area method; Castigliano's theorem and application; strain energy methods; theory of columns; Euler's column formula; secant, Rankine-Gordon and empirical formulae; stresses in simple and composite thick-walled cylinders and rotating discs; stresses due to shrink fits; contact stresses; theories of failure; mechanics of creep, fatigue, ductile and brittle failure; computational methods and software packages for analysis in strength of materials.

MEE 315: FLUID MECHANICS II 2 UNITS

Ideal flow theory: Introduction to concepts of vorticity and circulation, rotational and irrotational flows, flow fields, velocity potential, streamlines and stream functions; **viscous flow theory:** Mechanism of viscosity, Equations of motion for viscous Newtonian fluids, Navier-Stokes equation for laminar flows, simplified forms and some exact solution, Prandtl mixing length, Laminar and turbulent flows through pipe systems, Boundary layer theory, drag on immersed bodies, Lift

aerofoil theory; **Compressible flow:** 1-D isentropic flows, venturies and

orifices, De-Laval nozzle, shock waves, Fanno and Raleigh flows, isothermal flow; introduction to turbomachinery, cavitation.

MEE 316: THERMODYNAMICS AND HEAT TRANSFER 2 UNITS

Thermodynamics: Mixtures; vapour power cycles: Introduction to vapour power cycles; Rankine cycle with super heat and reheat; 2nd law of thermodynamics – availability or exergy. **Heat Transfer:** modes of heat transfer: conduction, convection and radiation; basic concepts of conduction; basic laws of conduction, thermal conductivity, differential equation of conduction, boundary conditions; steady-state conduction through solids: heat transfer through a single layer slab, composite plane slabs, single cylinder wall, multi-layer composite cylindrical wall, heat transfer by conduction through a spherical wall; steady-state conduction from fluid to fluid: heat transfer through plane and composite walls of a cylinder; critical diameter of insulation; heat transfer through a spherical wall, conduction with heat sources; transient conduction: the quenching of billets, numerical solution of unsteady one-dimensional conduction, two-dimensional conduction.

MEE 317: BASIC SAFETY ENGINEERING 1 UNIT

Principles of general safety and safety education; home safety, safe working practices; electrical safety; mechanical hazards; chemical hazards; environmental hazards; safety in hazardous area; industrial safety and analysis; fire safety, personal protection and fire arm safety; Road traffic and pedestrian safety; Occupational safety; Natural and man-made disasters; Health assurance.

MEE 319: MECHANICAL ENGINEERING LABORATORY I 3UNITS

Laboratory experiments in Strength of Materials, Fluid Mechanics, Thermodynamics, Heat Transfer, Mechanics of Machines, Materials Production, Manufacturing Processes and Electrical Machines.

MEE 321: MECHANICAL ENGINEERING DESIGN I 2 UNITS

Design Concepts: Design and design process; creativity and creative process in design; rational and creative design methods; concept of model and optimum in design; methods of research for best solution; material selection; use of handbooks and standards; detail, assembly

MEE 324: METALLURGY I**2 UNITS**

Iron and Steel: Their production, properties and uses. The iron-carbon phase diagram. Cast Iron and Plain carbon steels.

Alloy Steels: Stainless steels, tool steels, Iron and steel.

Classification/Nomenclature: Heat treatment of steel: Diffusion in metals, types and mechanisms, Nomenclature and growth process. TTT diagrams. Microstructure/property relationships. Thermal processing, Annealing, Normalizing and tempering. Surface hardening of steels.

Deformation and Strengthening Mechanism: Dislocation and plastic deformation. Types of deformation. Mechanisms of strengthening in metals (solid solution, precipitate, grain boundary, work hardening, dispersion).

Metallography: Principles and application of macro and micro-examination.

MEE 326: HEAT TRANSFER**2 UNITS**

Heat transfer by convection: Fundamentals of heat transfer by convection, pattern of flow and the boundary layer, heat transfer coefficient; Differential equations of heat transfer; Reduction of differential equations of convection heat transfer and of conduction unambiguity to dimensionless form; criterion equations; Heat transfer in laminar; turbulent and transfer flows in tubes; Heat transfer by free convection; Nucleate boiling;

Thermal radiation heat transfer: General data on thermal radiation, basic law of absorption, basic laws of thermal radiation heat transfer, Planck's law, Stefan-Boltzmann's law, Kirchoff's law, Lambert's law, Cosine law; Radiation heat transfer between solids: parallel plates, bodies one of which is stipulated inside the other, bodies arbitrary arranged in space; extended surfaces;

Heat exchangers: Types of heat exchanger; Basic heat calculation: Calculation of outlet temperatures of hot fluid in parallel flow, counter-flow and cross-flow.

MEE 327: MECHANICAL SYSTEMS INSTRUMENTATION 2 UNITS

Introduction; elements in a measuring system; static characteristics of measuring systems; dynamic characteristics of measuring systems; measurement errors and error analysis; measurement of length: linear displacement and surface finish; measurement of angle: angular displacement and alignment; measurement of stress and strain; measurement of time, speed, acceleration and frequency; measurement of force, torque and pressure; measurement of power and efficiency; measurement of fluid flow and viscosity; measurement of liquid-level and quantity; measurement of temperature; measurement of vibration.

MEE 329: MECHANICAL ENGINEERING LABORATORY II 3UNITS

Laboratory experiments in Metallurgy, Materials Production and Manufacturing Processes, Heat Transfer, Mechanical Systems Instrumentation.

400 LEVEL**MEE 411: MECHANICAL ENGINEERING DESIGN II 3UNITS**

Machine Element design: Keys and pins; bolted, riveted, welded, brazed and bonded joints; Tanks, thin-walled and thick-walled pressure vessels; shrink fits and splines; springs; couplings, clutches, brakes and flywheels, shafts and axles; belts, chains and sprockets; gears; bearings; computer algorithms, programs and packages for design of machine elements.

Machine Element Design projects: Students will be required to carry out projects involving the use of computer and manual drafting in the design of suitable machine element to fulfill given specification; selection of appropriate materials for the component, and calculate its size; making of appropriate layout drawings.

MEE 414: METALLURGY II 2 UNITS

Non-ferrous metals and alloys: Production, proportion and uses of common engineering metals/alloys including Aluminum, copper, tin, titanium. Materials for high temperature applications. Bearing

materials.

Non-metallic materials: An introduction to polymers, ceramics and composites; their types, properties and application.

Degradation of materials: An introduction to corrosion and high temperature oxidation. Corrosion control methods. Degradation of polymers and ceramics.

Fabrication of materials: Forming operations (Types-forging, rolling and Extrusion). Casting; solidification principle. Casting techniques and defects.

MEE 415: TURBOMACHINERY 2 UNITS

Review of Basic Thermodynamics and Fluid Mechanics.

Classification of fluid machines: Theory of rotodynamic machines. Euler's and one-dimensional theories

Theory of rotodynamic machines: One dimensional theorem, isolated and cascade considerations, departure from Euler's theory and losses, compressible flow through rotodynamics machines; Performance of rotodynamics machines, performance of rotodynamic machines, performance characteristics, losses and efficiencies; dimensionless coefficients, similarity laws and scale effects;

Non-positive displacement machines: centrifugal pumps and fans, axial-flow pumps and fans, water turbines, Pelton wheel, Francis turbines, axial flow turbines, fluid coupling and torque converter;

Positive displacement machines: reciprocating pumps, rotary gear, vane and piston pump, hydraulic motors; pipe machine: Pump and the pipe system, parallel and series pump operation, cavitations in pumps and turbines, pump selection

MEE 416: PRINCIPLES OF AIRCONDITIONING & REFRIGERATION 2 UNITS

Refrigeration: Production of low temperatures; Application of the second law; Thermodynamics of vapour compression: vapour compression cycle, Pressure-Enthalpy diagram and analysis, standard rating cycle and effect of operating conditions, actual compression cycle. **Refrigerants:** designation, selection and requirements, secondary refrigerants, binary mixture; Introduction to multipressure systems; Vapour absorption systems; Ejection-compression system. **Air conditioning:** Properties of moist; psychrometric properties,

psychrometric chart; Psychrometry of air-conditioning processes; Psychrometric processes in air-conditioning equipment; Simple air-

conditioning systems and state and mass rate of supply air; Summer and winter air-conditioning; Design conditions; Introduction to ventilation; Aspects of design and application of air-conditioning and refrigerating systems; Microprocessor in system controls; Computer-aided system design and analysis.

MEE 417: OIL & GAS INDUSTRY EQUIPMENT MAINTENANCE 3 UNITS

Features, operations and best practices in maintenance of major petroleum exploration, drilling, production, refining, and distribution equipment of both static and rotating configuration; maintenance operations, strategies and management; troubleshooting and fault diagnosis; equipment reliability, failure and failure analysis; equipment selection and replacement; practical maintenance and repair of static and rotating equipment; maintenance and repair equipment and tools; site visits where appropriate.

MEE 418: WORKSHOP PRACTICE (AUTO/R&A) 1 UNIT

Refrigeration and Air-conditioning (R&A) workshop practice: refrigeration and air-conditioning: principle of operation, refrigeration, refrigerant and troubleshooting; methods of leak detection, charging and discharging; safety precautions;

Automotive workshop practice: principle of operation of the motor car, tuning carburetor, setting ignition timing; engine routine maintenance procedure and engine service; tyre types and care; battery care, topping up and charging.

MEE 419: MECHANICAL ENGINEERING LABORATORY III 3 UNITS

Laboratory experiments in Metallurgy, Fluid Mechanics, Mechanics of Machines, Air Conditioning and Refrigerating Engineering, Vibration and Noise, Industrial and Production Engineering, Control Systems Engineering and Advanced thermodynamics.

500 LEVEL COURSE CONTENT

EEE 516: MECHATRONICS I 2 UNITS

Introduction: Mechatronics: What and Why? Mechatronic system design, sensors and transducers for displacement, proximity, velocity, force, pressure temperature measurement; Microprocessors – Introduction, structure micro-controllers, application programmable logic controllers – basic structure, specifications

programming of PLC's, importance of Timers, Counters, marker relays, analog comparators in PLC programming;

Introduction to Data Acquisition and virtual instrumentation using LABVIEW. **Essential electronics and Boolean algebra.**

Digital representation: Binary, decimal, hexadecimal, conversion from binary to decimal and vice-versa

Binary arithmetic: Addition, subtraction: 2's complement, multiplication and division, boolean algebra: AND, OR, NOT, NAND, NOR, XOR logic, truth table, realization of logic in physical systems: switches-LEDs, cylinders. Fundamental identities, De Morgan's theorems and relationship with sets, simplification

Electronics fundamentals: Review of some semiconductor devices, concepts of digital and analog systems, digital output (DO) and input (DI), using switches, transistors, pneumatic devices, etc. to realize DI & DO,

Operational Amplifiers: Principles, configurations, Inverting, summing, integrating and differentiating configurations, digital to analog conversion (DAC), the R-2R and summing Op-Amp circuit, analog to digital conversion (ADC), successive approximation method, flash method, etc., programs for DI, DO, DA and AD for PC based plug in cards.

MEE 511: MECHANICAL ENGINEERING DESIGN III 2 UNITS

Systems Design: Methods of systems analysis and synthesis applied to complete mechanical systems of interest to mechanical engineers; computer algorithms, programs and packages for mechanical systems design. **Design for production:** Design for casting, welding, heat treatment, metal and forming; design of machine structures; design for reliability, economic manufacture, assembly and disassembly, energy reduction, recyclables, safety, misuse, and maintenance; ergonomic consideration in design; computer algorithms, programs and packages for designing for production. **Systems Design projects:** students will be required to carry out projects involving the use of computer and manual drafting in the design of a suitable mechanical system to fulfill given specification.

MEE 512: MECHANICAL VIBRATIONS AND NOISE 2 UNITS

The general nature of free, forced and self-excited vibrations; lumped one and two degree-of-linear systems; free motion, natural mode and viscous damping; Electrical analogy; forces transmitted to supports; transmissibility, energy inputs and absorption; elements of the analysis of multi-body and distributed-mass linear systems; Raleigh's principle,

Holzer's method and application; torsional vibration, flexural vibration

of beams, whirling of a single disc on a shaft; whirling of shafts; introduction to transient vibration theory; vibration measuring instruments; vibration and noise control; computer-aided vibration and noise analysis and control.

MEE 513: COMPUTER AIDED DESIGN AND MANUFACTURE(CAD/CAM) 3UNITS

Introduction of CAD/CAM: History of CAD/CAM, market trend of CAD/CAM, Role of computers, Computer Aided Engineering, Computer Aided Manufacturing, Benefits of CAD. Hardware and software of CAD/CAM: types of system, systems evaluation criteria, input and output devices, hardware integration and networking, graphics standards, data structure, database management system, modes of graphics operations, user interface, software models, efficient use of software,

Geometric Modeling: Wire frame, Surface and Solid models, mathematical representation of curves, parametric representation of analytical and synthetic curves, curve manipulation, mathematical representation of surfaces, plane surface, ruled surface, Bezier surfaces, B-spline surfaces, coons surfaces, blending surfaces. Fundamental of solid modeling, half spaces, boundary representation. Solid modeling based applications Data exchange, IGES, PDES, geometrical transformations and visual realism.

Finite Element Analysis: Introduction, Procedures, Element types, Nodal approximation, Element matrices, vectors and equations, Global connectivity, Assembly, Boundary conditions, Solution techniques, Interfaces to CAD, Introduction packages, Software development for design of mechanical components

Computer Aided Manufacturing: Evolution of Computer Numerical Control, Components, Coordinate system, Working principle of CNC Lathe, Turning Centers, Milling Machine, Machining Center, Drilling Machine, Boring Machine,

Part Program Terminology: G and M Codes, Types of interpolation, Methods of CNC part programming, Manual part programming,

Computer Assisted part programming: APT language, CNC part programming using CAD/CAM-Introduction to Computer Automated Part Programming.

MEE 514: MATHEMATICAL MODELING AND OPERATIONS RESEARCH 2 UNITS

Basic concepts, methodology, structures, information support and systems approach; synthesis, analysis, validation and computer simulation of mathematical models; mathematical modeling of engineering problems at micro-, macro- and meta-levels; inverse problems; unconstrained and constrained problems; introduction to operations research; sensitivity analysis; linear, integer, goal, geometric, dynamic, nonlinear and stochastic mathematical programming; allocation routing, searching, project scheduling, sequencing, replacement, inventory, gaming and queuing problems; computer-aided mathematical modeling of engineering systems, processes and operations; application software packages

MEE 515: ROBOTICS, MECHANICS AND CONTROL 2 UNITS

Introduction to Robotics: Basic concepts, classification based on Geometry, programming, drives, work volume of robot's world and joint coordinates various joints, DOF, end effectors – Types and uses, Sensors in Robots, programming – Teach pendant and Computer programming, Introduction to forward and inverse kinematics, Applications of Robots. **Kinematics and Dynamics of Robotic linkages (open ended type manipulators):** Frames, Transformations: Translation and rotation, Denavit-Hartenberg parameters, Forward and Inverse Kinematics, Jacobian, Dynamics: Equations of motion, Newton-Euler formulation **Sensors and actuators:** Strain gauge, resistive potentiometers, Tactile and force sensors, tachometers, LVDT, Piezo electric accelerometer, Hall effect sensors, Optical Encoders, Pneumatic and Hydraulic actuators, servo valves, DC motor, stepper motor, drives
Control of Manipulators: Feedback control of 2^{nd} – order linear systems, Joint control, Trajectory control, Controllers, PID control

MEE 531: QUALITY AND RELIABILITY ASSURANCE 3 UNITS

Review of probability and statistics; control charts; acceptance sampling plan for attributes, continuous production and variables; reliability; data collection and analysis; quality and reliability costs; product liability; reliability of machine elements and mechanical systems; maintenance engineering; ergonomics, environmental and safety assurance; computer algorithms, programs and packages for quality and reliability assurance studies; introduction to total quality management (TQM).

MEE 535: BUILDING SERVICES ENGINEERING 3 UNITS

Basic concepts of the building environment; building energy economics; thermal analysis of buildings; heating, cooling, ventilating air-conditioning of buildings; hot and cold water supplies; soil and waste systems; surface water and below-ground water drainage; condensation in buildings; lighting; gas services; electrical installations; mechanical transport; fire protection; refuse disposal; plant and service areas; installation and maintenance of mechanical and electrical equipment for buildings; computer controls and methods in building services engineering; design projects.

EEE 525: MECHATRONICS II 1 UNIT

Microprocessor, Computers and Embedded systems: Introduction to the 8085 (8-bit microprocessor) and microcontroller: Architecture, programming, I/O, computer interfacing, programmable logic controller basics

Sensors and actuators: Strain gauge, resistive potentiometers, tactile and force sensors, tachometers, LVDT, Piezo electric accelerometer, Hall effect sensor, optical encoder, resolver, inductosyn, pneumatic and hydraulic actuators, stepper motor, DC motor, AC motor

Control Systems: Mathematical modeling of physical systems, system equations, controllability and observability, pole placement, PID controller, control of hydraulic, pneumatic, mechanical and electrical Systems

Integration and case studies: Integration of mechatronics component subsystems into complete mechatronics system applications to CNC machines and robotics.

MEE 521: ENGINEERING MATERIALS SELECTION 2 UNITS

Design with Materials, Introductory case study; Materials data, databases and graphical representation of materials properties; Deriving material indices and basic materials selection; Checking and estimating materials data; Materials selection by successive application of property limits and indices; Materials Selection problems with

multiple constraints and compound objectives, Penalty functions, Value functions; Selection of material and shape; Shape factors, Structural sections and mechanical efficiency, Material indices that include shape, Material limits for shape factors, Microscopic and micro-structural shape factors; Materials processing and its influence on design, Process attributes, systematic process selection, Process selection diagrams, Process cost and cost modeling; Designing hybrid materials; Materials selection for sustainable and environmentally conscious design; Design Project Presentations.

MEE 522: CONTROL SYSTEMS ENGINEERING 2 UNITS

Nature and use; classification and terminology of automatic controls; modeling of mechanical, hydraulic, thermal and electrical systems; block diagrams (types and transformation) and transfer functions; review of Laplace transforms; concept and purpose of feedback; description of simple systems in process control, position control and regulation; representation of control systems by differential equations; representation of transfer functions by poles and zeros on the s-plane; computation of modulus and phase from pole-zero patterns, residues, modulus and phase contours; transient response from the s-plane; closed-loop analysis of systems; root locus, close-loop poles and modes; stability assessment criterion; damping ratios and angles; harmonic response locus and its derivation from the s-plane pattern by conformal transformation; gain and phase margins, contours of closed-loop modulus and use of hall chart; bode diagram relationship between gain and phase; Nichols diagrams and its use; use of digital computers in solving first and second order differential equations; fundamentals of scaling; computer-aided design and analysis of control systems.

MEE 523: TECHNOLOGY POLICY AND DEVELOPMENT 2 UNITS

Technology policy within the framework of national development; technological choice; appropriate technology dependence; technology employment and economic growth; development of local technology capacity; new and emerging technologies.

MEE 524: THEORIES OF ELASTICITY AND PLASTICITY 3UNITS

Three-dimensional analysis of stress and strain in Cartesian and curvilinear coordinates, applications to axi-symmetric problems; equations of equilibrium and compatibility; formulation of general elastic problems; generation and application of stress functions; introduction to theories of circular plates and shells; energy and numerical methods for analysis of plates and shells; experimental stress analysis using various techniques; formulation of elastoplastic problems; various methods of solution; application to metal forming, thick-walled pressure vessels and rotating discs; computational methods and software packages for study of elasticity and plasticity problems.

MEE 525: INDUSTRIAL AUTOMATION 3UNITS

Introduction: Basic concept of Automation, Types of Automation, Feasibility etc.

Industrial Hydraulics: Introduction, basic concepts, hydraulic fluids, classification and properties of hydraulic fluids, contaminants in hydraulic system, control and cleanliness standards, fluid power generators, i.e. Gear, Vane, Piston pumps, linear and rotary actuators, direction control valve types, actuation methods, pressure control valves; pressure reducing valves, pressure relief valve, unloading valve, Sequence valve, counterbalance valve, flow control valves simple and pressure compensated type. Standard ISO Symbols for Hydraulic components. Seals in hydraulic system, Accumulators, hydraulic hoses and tubing, design and analysis and hydraulic circuits, conventional as well as computer aided design.

Industrial Pneumatics: Introduction, Basic components, Source, storage and distribution, treatment of compressed air, linear and Rotary actuators, direction control valve types, actuation methods, pressure control valves, logic devices – twin pressure valve, shutter valve, time delay valve, Pneumatic circuit design and analysis, conventional as well as computer aided design.

Automatic Assembly System: Development of Automatic Assembly process, Transfer devices – continuous, Intermittent, synchronous and asynchronous,

Refrigeration engineering: Multi-pressure systems; Refrigerant compressors and their design; performance and selection; Design of refrigerant condensers, expansion devices and evaporators; Complete vapour compression system; Gas cycle refrigeration; Vapour absorption systems; Ejector-compression system; Refrigeration control systems; Application; Computer application in refrigerating Engineering.

MEE 526: POWER PLANT ENGINEERING 3UNITS

The World and Nigeria's energy demand; Methods of electrical power generation; Steam power generation cycles, steam generators and turbines, condensers, water heaters, pumps and auxiliaries; Gas power generation cycles, gas turbines, combustors and auxiliary equipment; Nuclear power generation; Hydropower generation; Alternative energy sources; Energy storage; Economics of power generation; Computer-aided Power Plant Engineering, Industrial visits to at least one each of the hydro, steam and gas turbine power stations in the country.

MEE 517: INDUSTRIAL ENGINEERING 2 UNITS

A brief history of Industrial Engineering; Plant layout and organization of industry; Productivity analysis, production fundamentals and manufacturing economics; Quality control, inventory control, cost control; Operations planning and control; Financial compensation; CAD/CAM, robotics and automation; Ergonomics; Resource management; Application of operations research techniques to industrial Engineering problems; Computer methods and software packages for industrial Engineering analysis

MEE 533: NUMERICAL CONTROL MACHINE TOOLS 3UNITS

The basic design structure of numerical control (NC) machine tools; Open – and – close – loop NC; Input media and data coding in NC; Point to point manual programming; Economics of NC and selection of machines; NC manual part programming for manufacturing jobs requiring linear and circular interpolations; Continuous part programming; Special NC languages, the Automatically Programmed Tool (APT) language; Advances in numerical control machine tools; Pre – requisite: Good academic standing.

MEE 537: INDUSTRIAL VENTILLATION AND AIR – POLLUTION CONTROL SYSTEMS 3UNITS
The role of air pollution control in modern society; Scope and nature of industrial ventilation and air – pollution control; Dynamics of particles in fluids; Pollutant distribution and collection efficiencies; Design of industrial ventilation systems; Settling chambers; Inertial devices Electrostatic precipitators; Particulate scrubbers; Filters; Absorption and adsorption devices Combustion and condensation devices; Computer algorithms and programs for design and analysis of ventilation and pollution control systems; Pre- requisite; Good academic standing.

MEE 527: PRODUCTION ENGINEERING 3UNITS
Advanced topics in machine tool analysis and cutting tool design; Gear and cam design and manufacture; Gear cutting machines; Unconventional machining techniques; Tools and die design; Facilities design; Production management, planning and control; Group technology; value engineering, Production economics; works study, Computer-aided production analysis and design.

MEE 518: FRACTURE AND FATIGUE OF ENGINEERING MATERIALS 2UNITS
Introduction to Fracture and Fatigue: Fundamental failure modes of materials; Examples of fracture and fatigue failures; Fractography, physical basis for fracture; Griffith fracture theory. **Linear Elastic Fracture Mechanics:** Crack tip stress singularity and the stress intensity factor; Plasticity considerations, small-scale yielding; Plane stress vs. plane strain; Resistance curves; Test methods and applications. **Elastic-Plastic Fracture Mechanics:** J-integral, HRR singularity; Crack tip opening displacement, JR resistance curves; Test methods and applications. **Fracture Mechanisms of Brittle Materials:** Defects and flaws in ceramics; Brittle fracture statistics, Weibull modulus; Toughening mechanisms. **Fracture Mechanisms of Ductile Materials.** **Fatigue:** Total lifetime approach (crack initiation, stress-life vs. strain-life); Damage tolerant approach (crack growth, Paris law); Fatigue mechanisms. **Special topics:** Creep fracture; Stress corrosion cracking.

MEE 534: METAL FORMING AND FINISHING TECHNOLOGY 3UNITS

Rolling: hot and cold rolling processes, defects in rolled metals; forging: forging operations, forging machines and up-setters; Extrusion and drawing: direct and indirect extrusion, alloys suitable for extrusion; wire, rod and tube drawing; deep drawing: drawing and deep drawing, machine tool for drawing, lubrication and drawing defects; other cold working processes: shearing, bending, spinning, stretching, coining and embossing; Powder metallurgy: metal powders, mixing and blowing, pressing, sintering, sizing and impregnation; Surface treatment: metal cleaning techniques, techniques for surface treatment; Electroplating: principles, plating of metals, preparation and maintenance of plating solution, quality control, stripping of faulty deposits, design of process charts; other metallic coatings

MEE 538: CORROSION CONTROL AND PROTECTION 3 UNITS

Cost of Corrosion: Corrosion principles, electrochemical aspects. Environmental effects. Main forms of corrosion. Corrosion threats in oil and gas productions. Measuring corrosion rates (corrosion coupons and probes, corrosion monitoring. Corrosion mitigation control methods. Design for corrosion control. Elements of CP design.

MEE 528: STEEL MAKING TECHNOLOGY 3UNITS

Principles of Steel Making: Development of steel making processes, physico-chemical principles and kinetic aspects of steel making, carbon boil, oxygen transport mechanism, desulphurisation, dephosphorisation, slag-functions, composition, properties and theories, raw materials for steel making and plant layout. **Bessemer and Open Hearth Steel Making:** Acid and Basic Bessemer processes, Side Blown Converter, O.H-constructional features, process types, operation, modified processes, duplexing, pre-treatment of hot metal. **Oxygen Steel Making Processes:** Top Blown processes- L.D., L.D.A.C., bottom blown processes, combined blown processes, rotating oxygen processes-kaldo and rotor, modern trends in oxygen steel making processes. **Electrical Steel Making and Ladle Metallurgy:** Arc and Induction furnace-constructional features. Production practice for plain carbon steels, low alloy, stainless, tool and special steels, modern

developments. Secondary steel making processes, continuous steel making processes. **Deoxidation and Teeming Practice:** Principle, methods and their comparison, killed, rimmed and capped steels, degassing practices, ingot production, ingot defects and remedies, continuous casting. Nigerian steel industry and global trends in steel making technology.

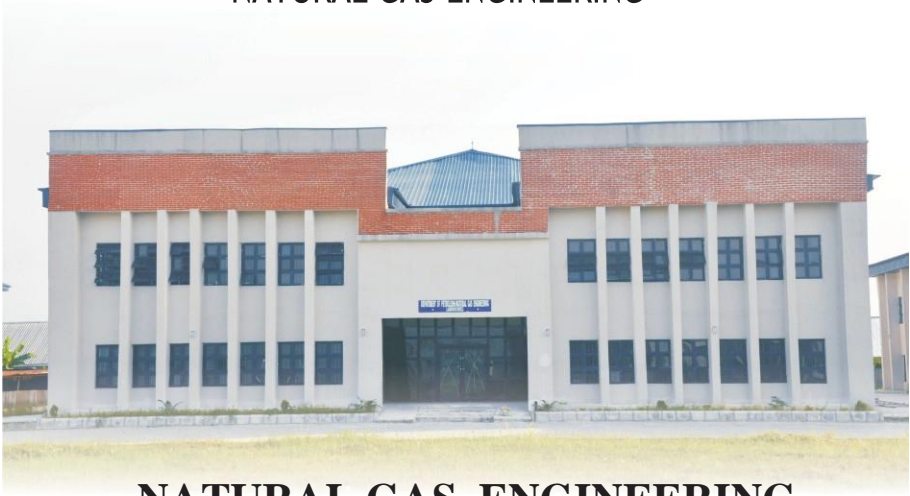
MEE 598: FINAL YEAR PROJECT AND SEMINAR 6UNITS

Final year Project: Individual Final year Research Projects, which could be in the areas of Applied Mechanics and Design, Production and Industrial Engineering, Thermo-Fluids, and Materials and Metallurgical Engineering. In these areas, students are to undertake research projects involving design of mechanical systems; design, construction and testing of mechanical systems; experimental and simulation studies; review, appraisal or evaluation of mechanical engineering processes; and theoretical or feasibility studies. Emphasis should be placed on practical oriented projects involving experimental studies, and design, construction and testing.

Seminar: students are to present two seminars derived from final year project work each in a semester.

CHAPTER EIGHT

DEPARTMENT OF NATURAL GAS ENGINEERING



NATURAL GAS ENGINEERING LABORATORY

TITLE OF DEGREE PROGRAMME

This is the degree of bachelors of Engineering (B. Eng)

INTRODUCTION

Natural Gas Engineering involves the application of basic science, engineering and geology skills to the optimal production, processing, transportation/transmission and distribution/utilization of natural gas, condensates and related substances. Natural gas engineers supervise and improve production and natural gas-processing operations. They study and understand geologic and engineering principles to predict maximum natural gas recovery, ultimate production, production rates and gas processing and utilization technologies. Natural gas engineering study includes topics such as how to extract gas and natural gas liquids efficiently from reservoirs taking into account geology, well locations, well type and production history, well performance, injection and production strategies, reservoir and fluid characteristics, economics, conventional and unconventional subsurface resources and several other factors.

Natural gas engineers are employed in a wide range of occupations with different roles. As well-log analysts, the job of a natural gas engineer is to study extraction techniques for optimal exploitation of the resources from the earth as possible. They determine the best strategy according to factors such as geological conditions and the volume of gas present at the site. As drilling, production or reservoir engineers, they design processes to exploit resources efficiently, using drills, chemicals and other gases and tools. A well-log analyst evaluates a well's potential while a drilling engineer is responsible for finding oil and gas, designing and drilling the well as cheaply as possible. The production engineer analyses and optimizes the performance of individual wells, to

determine how to bring the fluid to the surface and to develop a system of surface equipment that separates the oil, gas, and water. Reservoir engineers determine the fluid and pressure distributions throughout the reservoir, the natural energy sources available, and the methods to recover the maximum amount of oil or gas from the reservoir. In order to maximize the potential of reserves, they collaborate with specialists such as geologist, corrosion and pipeline engineers amongst others, to create optimal solutions.

PHILOSOPHY

The philosophy of the programme is to be produce competent Natural Gas Engineers needed to meet the manpower requirements in the global Oil and Gas sector.

To achieve national goals and objectives of industrialization and self-reliance in the energy sector through the production of competent graduates in Natural Gas Engineering with high academic standard and adequate practical background needed to meet the manpower and entrepreneurial requirements of the energy and allied industries.

AIMS/OBJECTIVES

The aims of the proposed Bachelor degree programme in Natural Gas Engineering are to:

- i. Provide the much-needed technical manpower required to drive the gas revolution and development along the gas value chain in Nigeria and beyond.
- ii. Produce competent Engineers that are suitable for employment in the upstream, mid-stream and downstream sectors of the energy industry.

- iii. Develop the requisite capacity for the economic exploitation of the abundant natural gas resources in Nigeria and the gulf of Guinea.
- iv. Develop skills of analysis and synthesis necessary for high-level talents of professionalism in scientific research and
- v. technological innovations necessary for the technological challenges of the petroleum, natural gas and energy industries.

The specific objectives of the Gas Engineering programme are as follows:

- i. Production of competent Natural Gas engineering graduates that would be experts in proffering solutions to problems associated with gas value addition.
- ii. Production of competent Natural Gas engineering graduates that should be confident enough to establish small scale gas-based enterprises where ready-made jobs are not available.
- iii. Developing in the students the necessary skills and the ability to use up-to-date techniques of Natural Gas Engineering in handling gas production and processing, installation, maintenance, troubleshooting, analyses, design and development of novel ideas in the subject area.
- iv. Offering globally competitive and locally responsive undergraduate training in Natural Gas Engineering for allied industries.
- v. Provision of critical manpower in the development of natural gas and energy-based industries in Nigeria.

- vi. Production of graduates with competency in global gas business, trade and politics.

RATIONALE/JUSTIFICATION

The rationale of the programme is designed to suit the university philosophy, mission and vision. To justify the programme design, stated below is the university philosophy, mission and vision:

ADMISSION REQUIREMENT AND DURATION OF STUDY

Admission

Candidates can be admitted into the degree programme through any of the following modes of entry into Nigerian universities:

- i. The Unified Tertiary Matriculation Examination (UTME)
- ii. Direct Entry (DE)
- iii. Inter-University Transfer (IUT).

Unified Tertiary Matriculation Examination (UTME): 5-Year Programme

In addition to obtaining an acceptable score in UTME, candidates for admission into the B.Eng. Natural Gas Engineering programme must possess a minimum of five credit passes in English Language, Mathematics, Physics, Chemistry and any other science subject (Biology, Agricultural Science, Further Mathematics, Technical Drawing and Geography) at 'O' Level, in nationally recognised examinations (WAEC, GCE, NECO and NABTEB) at not more than two sittings.

Direct Entry Mode: 4 -Year Programme

- i. Candidates for Direct Entry admission into the programme must, in addition to satisfying the above specified 'O' Level requirements, possess passes in Mathematics, Physics and Chemistry at

GCE 'A' level or its equivalent to be eligible for admission into 200 Level of the programme.

- ii. Holders of OND and HND with a minimum of Upper Credit are also eligible for admission into 200 Level of the programme.

Inter-University Transfer Mode: 4 - Year Programme

Students can be admitted through this mode into 200-Level of the programme, provided they have the requisite 'O' level qualifications as prescribed for admission through the UTME mode and a minimum CGPA of 2.00. Students who transfer from other universities shall be credited with only those courses deemed relevant to the programme, which they have already passed prior to their transfer. Such students shall, however, be required to pass the minimum number of units specified for graduation for the number of sessions they are left to spend in the Faculty. Thus, no student on transfer shall spend less than four sessions (eight semesters) in order to earn a degree. Students who transfer from another programme in the Faculty or other Faculties for any approved reason shall be credited with those units passed that are within the curriculum of the programme from which they had transferred. Appropriate decisions on transfer cases are subject to the approval of Senate on the recommendation of the College/Faculty Board.

Duration of the Programme

Like any other engineering programme in Nigerian universities, the minimum duration of the B. Eng. Natural Gas Engineering programme is five academic sessions (10 Semesters) for UTME students. Direct Entry students enrolled in 200 level of the programme will spend a minimum of four academic sessions (Eight Semesters). Therefore, a student must spend the required number of years in accordance with his point of entry before graduation.

COURSE CONTENT

200-LEVEL COURSE STRUCTURE

200 LEVEL FIRST SEMESTER						
COURSE CODE	COURSE TITLE	L	T	P	CREDIT UNIT	STATUS
EEE 211	Basic Electrical Engineering I	2	-	-	2	C
GET 211	Engineering Mathematics I	2	1	-	3	C
GET 212	Engineer - in - Society	2	-	-	2	C
GET 219	Engineering Laboratory I	-	-	6	2	C
MEE 211	Engineering Drawing I	-	-	3	2	C
MEE 212	Engineering Mechanics I	2	-	-	2	C
MEE 213	Basic Manufacturing Technology	2	-	-	2	C
MEE 214	Engineering Materials	2	-	-	2	C
MEE 215	Fluid Mechanics	2	-	-	2	C
MEE 216	Basic Thermodynamics	2	-	-	2	C
PEE 211	Introduction to Oil and Gas Industry	1	-	-	1	C
TOTAL CREDIT UNITS					22	

200 LEVEL SECOND SEMESTER						
COURSE CODE	COURSE TITLE	L	T	P	CREDIT UNIT	STATUS
CVE 221	Basic Civil Engineering	2	-	-	2	C
EEE 221	Basic Electrical Engineering II	2	-	-	2	C
GET 221	Engineering Mathematics II	2	1	-	3	C
EEE 222	Information Technology in Engineering	2	1	-	2	C
GET 229	Engineering Laboratory II	-	-	6	2	C
MEE 221	Engineering Drawing II	-	-	3	2	C
MEE 222	Engineering Mechanics II	2	-	-	2	C
GET 223	Basic Workshop Practice	-	-	3	1	C
MEE 224	Strength of Materials I	2	-	-	2	C
NGE 221	Introduction to Natural Gas Resources Technology	2	1	-	2	C
GET 299	Student Work Experience Programme (SWEP) II	-	-	-	2	C
TOTAL CREDIT UNITS					22	

300-LEVEL COURSE STRUCTURE

300 LEVEL FIRST SEMESTER						
COURSE CODE	COURSE TITLE	L	T	P	CREDIT UNIT	STATUS
GSE 311	Entrepreneurial Studies	2	-	-	2	C

HANDBOOK OF GENERAL INFORMATION FOR UNDERGRADUATE STUDENTS

GET 311	Engineering Mathematics III	2	1	-	3	C
MEE 317	Basic Safety Engineering	1	-	-	1	C
NGE 311	Oil & Gas Separation Processes	2	1	-	2	R
PEE 311	Rock & Fluid Properties	3	-	-	3	C
NGE 312	Natural Gas Utilization and Monetization Concepts	3	-	-	3	C
PEE 310	Fundamentals of Reservoir Engineering	2	1	-	2	R
PEE 313	Thermodynamics & Phase Behaviour	3	-	-	3	C
PEE 314	Petroleum Geology	3	-	-	3	C
NGE 315	Petroleum/Natural Gas Engineering Laboratory	-	-	3	1	C
TOTAL CREDIT UNITS					23	

300 LEVEL SECOND SEMESTER

COURSE CODE	COURSE TITLE	L	T	P	CREDIT UNIT	STATUS
GET 321	Engineering Mathematics IV	2	1	-	3	C
GET 322	Technical Report Writing and Seminar	1	-	-	1	C
NGE 321	Transport Phenomena	2	-	-	2	R
PEE 321	Drilling Engineering	2	-	1	2	C
PEE 322	Well Completion & System Design	2	1	-	2	C
PEE 324	Applied Geophysics and Petroleum Exploration	2	-	-	2	C
NGE 320	Natural Gas Reservoir Engineering	3	1	-	3	C
NGE 325	Natural Gas Engineering Instrumentation Laboratory	-	-	3	1	C
PEE 326	Oil & Gas Pollution Studies & Control	2	-	-	2	R
GET 399	Student Work Experience Programme (SWEP) III	-	-	-	3	C
TOTAL CREDIT UNITS					21	

400-LEVEL COURSE STRUCTURE

400 LEVEL FIRST SEMESTER						
COURSE CODE	COURSE TITLE	L	T	P	CREDIT UNIT	STATUS
GET 411	Engineering Mathematics V	3	-	-	3	C
NGE 410	Natural Gas Engineering	3	1	-	3	C
NGE 411	Corrosion Science and Engineering	1	-	-	1	C
NGE 412	Natural Gas Processing and Plant Design	3	-	1	3	C
NGE 413	Gas to Power Generation and Emission Management	2	-	-	2	C
NGE 414	Natural Gas Transportation and Pipeline Technology	2	1	-	2	C
NGE 415	Natural Gas Technology Laboratory	-	-	3	1	C
PEE 414	Petroleum Production Engineering	3	1	-	3	C
PEE 416	Petroleum Refining Technology Processes	2	-	-	2	C
NGE 416	Technical Seminar / Group Project				1	

400 LEVEL SECOND SEMESTER			
Course Code	Course Title	Credit Unit	Status
GET 429	Student Industrial Work Experience Scheme (SIWES)	6	C
TOTAL CREDIT UNITS		6	
TOTAL CREDIT UNITS		21	

500-LEVEL COURSE STRUCTURE

500 LEVEL FIRST SEMESTER						
COURSE CODE	COURSE TITLE	L	T	P	CREDIT UNIT	STATUS
GET 511	Engineering Law	2	-	-	2	C
NGE 510	Natural Gas Technology Process Control	2	-	-	2	C
NGE 511	LNG and GTL Technologies	3	-	-	3	C
NGE 512	Natural Gas Economics and Trade	2	-	-	2	R
NGE 513	Offshore Gas Production and Flow Assurance	3	-	-	3	C
NGE 514	Combustion Technology	3	-	-	3	C
NGE 515	Energy, Oil & Gas Laws	2	-	-	2	C

HANDBOOK OF GENERAL INFORMATION FOR UNDERGRADUATE STUDENTS

NGE 516	Software Application in Gas Industry	2	-	1	2	C
NGE 598	Final Year Project & Seminar	-	-	9	-	C
TOTAL CREDIT UNITS					19	

500 LEVEL SECOND SEMESTER						
COURSE CODE	COURSE TITLE	L	T	P	CREDIT UNIT	STATUS
GET 521	Engineering Management	2	-	-	2	C
NGE 520	Natural Gas Reservoir Modelling and Simulation	2	-	-	2	C
NGE 521	Gas Handling, Processing and Safety	3	-	-	3	C
NGE 522	Unconventional Gas Technology	2	-	-	2	C
PEE 523	Production Enhancement & Optimization	3	-	-	3	C
NGE 524	Integrated Field Development & Planning	2	-	-	2	R
NGE 598	Final Year Project & Seminar	-	-	9	6	C
TOTAL CREDIT UNITS					20	

NGE 221: Introduction to Natural Gas Resources Technology 2 UNITS

Geophysical methods of petroleum exploration; Principles of petroleum geology; Drilling for oil and gas: Oil and gas reservoir; Oil and gas production; Oil and gas processing; Oil and gas transportation. Unconventional Sources; Shale Gas, Gas hydrates, Coalbed Methane, Landfill and Biogas technology.

300 LEVEL

PEE 311: Rock and Fluid Properties

Reservoir rock properties, rock and fluid properties (interaction between rock and fluids), fluid properties. Elements of hydrocarbon reservoirs; Definition and measurement of the reservoir rock properties such as porosity, permeability

(absolute and relative) and Darcy's law in porous media flow. Fluid saturations, compressibility and interfacial phenomena (surface energy, surface tension, energy of adhesion and cohesion, wettability and capillary, refractive index and electrical conductivity). Fundamental properties of multiple fluid saturated rocks; correlation between rock properties

NGE 312: Natural Gas Utilization and Monetization Concepts 3 UNITS

Fundamental technologies and Engineering aspects of industrial gas utilization. Relevant aspects of fluid dynamics, heat transfer, combustion, and acoustics, Technology of industrial gas utilization, including refractory materials, burner and furnace design, safety, measurement and control. Gas utilization in the following industries: glass, aluminum, steel, Fertilizer, petrochemicals, cement, paper and pulp, power plants, drying, and air conditioning. Temperature control of furnaces; waste heat recovery; efficiency of furnaces. Domestic gas utilization. Effects of gas prices, characteristics and quality. Emphasis will be laid on safety and control.

PEE 313: Thermodynamics and Phase Behavior

The P-V-T behaviour of pure substances; Equation of state for gases; The principle of corresponding state; Compressibility relations; reduced pressure; reduced 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, Gililand'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, Partial enthalpies, single and multiple effect evaporators with regards to heat effects. Thermodynamics of Flow Processes, Oil and gas

formation volume factors, viscosity. The liquid state; Physical properties of liquids, Transport properties of liquids, types of liquids. Binary and multi component systems with emphasis on the production of crude oil, natural gasoline, condensate reservoir. Vapour-Liquid Equilibria calculations.

NGE 315: Petroleum/Natural Gas Engineering Laboratory I **1 UNIT**

Laboratory experiments in oil reservoir rocks and fluids such as porosity, permeability, capillary pressure. Laboratory Section includes determination of rheological properties of drilling fluids.

PEE 314:Petroleum Geology

Origin, occurrence, movement, accumulation and exploration of hydrocarbon fuels. Distribution of hydrocarbon deposits and fields. Geology and Petroleum Geology. The Earth Core and Crustal Rocks, Sedimentary Rocks/Sedimentary Basin Analysis Petroleum Genesis and Habitat. Petroleum Reservoirs Petroleum Trapping Mechanism Seismology. Properties of Sedimentary rocks (texture, structure, composition). Reservoir Traps (Definition, classification, physical properties, fluid saturation before oil and gas trapping) Surface Geology Explorations (traces and shows of occurrences seeds) as

sampling stratigraphy, mineralogy, tectonics and petrology. Geophysical methods (gravimetry, magnetometry, seismic and electro methods) Subsurface geological exploration (drilling, well logging, geomechanical methods) Map Elaboration: Structural maps, Isobar maps, Isochore maps, Isoperm maps, facies maps, paleo - relief maps, cross - section, profiles construction of different types of maps, use of planimeter. Elaboration of basic and prognostic profiles of exploration and production wells. Evaluation of the reservoir. Oil and Gas

Resources in the world. Petroleum Geology of Nigeria.

PEE 310: Fundamentals of Reservoir Engineering

Introduction: Functions of a Reservoir Engineer; Characteristics of petroleum reservoir; Geological concepts in reservoir Engineering; Recovery methods and definitions of reservoirs. Determination of Hydrocarbon in-Place for oil and gas Recovery: Volumetric methods; Material balance and applications; water influx models and calculations; uncertainties in reserve calculations. Fluid flow concepts; flow potential; Darcy's Law. Decline Curve Analysis.

NGE 311: Oil and Gas Separation Processes

Overview of reservoir fluid separation, Principles and mechanisms of separation; Types of separators; Fundamentals of two-phase separation process; Applications of two-phase separation: oil and gas separation; Oil and water separation, oil desalting; Fundamental of three-phase separation; Applications of three-phase separation: gas, oil and water separation, gas, oil and solid separation; Phase equilibrium; Equilibrium calculation and its application in phase separation; Design and performance analysis of two- and three-phase separators.

NGE 320: Natural Gas Reservoir Engineering

Properties of gases; Gas reservoir system; Gas recovery; Associated and Non-Associated gas reservoir analysis; Study of Gas-Condensate

and under-saturated reservoir including recovery methods and recovery factor. Water influx theory as applicable to gas recovery. Material Balance Equation.

NGE 321:Transport Phenomena

Fundamentals of transport phenomena (fields, flux density,

field intensity, rate equation, conservation laws - Newton's, and Fick's); laminar and turbulent flow of incompressible viscous fluids (Isothermal flow over a flat plate, in tubes; non-isothermal flow); Flow in non-circular tubes; Non-Newtonian fluids; Heat transport - stationary and non-stationary heat conduction, Molecular diffusion in fluids; Interphase mass transfer; Diffusion in solids. Boundary-layer theory, Navier-Stokes equation and applications in Chemical Engineering problems; Turbulent flow in pipes and channels; one-dimensional compression flow; Energy equation; Free and forced convective heat transfer (over a flat plate, in a tube); Convective mass transfer, Introduction to multiphase phenomena (bubble dynamics, cavitation, fundamentals of two phase flow).

PEE 321:Drilling Engineering

Techniques for drilling oil wells; cable tool and rotary rigs: Derricks and masts, hoisting equipment, prime machine, drill string, casing, drill bits, drilling pumps, blowout preventers, circulating system. Drilling fluids - composition, functions, classification. Drilling parameters: Choice of drilling programme and drilling rig; mechanical parameters and their optimization - drilling bits; hydraulic parameters - mud calculations, control of mud properties. Well completion fluids. Drilling mud performance. Drilling hydraulics. Hydrostatic and formation overburden pressures. Coring. Geological work techniques. Drilling and casing programs. Drilling performance. Offshore drilling rigs. Fundamentals of rock mechanics. Crater formation. Plastic and pseudo-plastic characteristics of rocks load rate mechanism. Static and impact loading; tooth penetration as a function of differential and overburden pressures. Effect of differential pressures on drilling rate.

PEE 322:Well Completions and System Design

Well Design: Prediction of formation pore pressure and stress

gradients. Determination of safety mud weight bounds for different in-situ stress conditions. Design and planning well trajectory. Surveying tools and methods. Selection of casing shoes, material properties and design of casing program. Cementing: Equipment, hole conditions; calculations and rate of circulation, squeeze cementing, cement plug. Cementing quality and monitoring. Casing design: mechanical properties - tension, collapse and burst; designing a casing string. Well completion types including single and dual string completions. Smart well completions. Sizing of Tubular Goods. Perforating. Fundamentals of Vertical Multiphase flow. Single and two-phase flow through the tubing, choke, flowline and surface facilities.

PEE 326: Oil and Gas Pollution Studies and Control 2 UNITS

Causes of oil pollution; blowout; pipeline and flowline leakages, sour-gas production, sea transportation hazards. Need for oil spill prevention and control; Impact on the environment - ecology. Methods of control; mechanical, chemical and biological methods. Global pollution problems; Government regulations.

NGE 321: Corrosion Science and Engineering

The course is aimed at investigating the underlying fundamental causes of corrosion problems and failures. Emphasis is placed on the electrochemical reactions occurring and the tools and knowledge necessary for predicting corrosion, measuring corrosion rates, and combining these with prevention and materials selection.

NGE 325: Natural Gas Engineering Instrumentation Laboratory 2 UNITS

Applications for thermometers, pressure gauges, thermocouples, flow meters, and manometers in gas systems. Construction and operation of simple pipelines using steel and plastic pipes. Determination of rate of heat flow and thermal efficiency of burners and furnaces and boilers, Chemical

composition and flue gas analysis, Gas Chromatography, Mass spectrometer and Sampling System.

PEE 324: Applied Geophysics and Petroleum Exploration 2 UNITS

The physical methods involved in exploration for hydrocarbons and minerals. These tools include gravity, magnetic, seismic, electrical, electromagnetic, and radioactivity studies. All aspects of these methods including theoretical considerations, data acquisition, and data processing and interpretation, with the objective of locating concentrations of natural resources and defining their extent. Improved techniques for calculating gravity fields, the use of proton-precession and optically-pumped magnetometers, improved quality of seismic data, magnetotelluric as a practical exploration method, new electromagnetic exploration methods, the use of gamma-ray spectrometers in radioactive exploration, and improved well-logging techniques.

400 LEVEL

NGE 410: Natural Gas Engineering

Production and Transportation of Gas: Gas Flow in Pipes; Compression; Well Performance; Estimation of Gas Reserves (Conventional and Unconventional): Field handling of Natural Gas; Sour Gas Problems; Gas Condensate Fields and Storage of Gas. Production from both conventional and unconventional sources.

NGE 411: Corrosion Science and Engineering

The course is aimed at investigating the underlying fundamental causes of corrosion problems and failures. Emphasis is placed on the electrochemical reactions occurring and the tools and knowledge necessary for predicting corrosion, measuring corrosion rates, and combining these with prevention

and materials selection.

NGE 412: Natural Gas Processing and Plant Design

Process flow sheet; Material and Energy balance; Design of valves, Gas Gathering systems simulation and design, Design of Contactors, Separators, Heat Exchangers and Storage Tanks. Design of Gas Compressors, and other allied equipment. Simple Design Projects. Software Application.

NGE 413: Gas to Power Generation and Emission Management

2 UNITS

Basic Thermodynamics, Steam Power cycles, Gas Turbine Cycles and Combined Cycles, Cooling Towers and Condensers, Ideal engines Cycles, Refrigeration and Heat Pumps. Industrial Air Pollution Monitoring Particulate and Gaseous Emissions. Combustion and Emission Calculations for solid, liquid and gaseous fuels or wastes.

NGE 414: Natural Gas Transportation and Pipelines Technology 2 UNITS

Transportation in the petroleum industry. Pipeline design specifications and standards. Pipeline design models, conventional models and Energy Cost Optimization models. Gas pipeline handling facilities, compressors/pumps, sizing, selection and operations. Corrosion control. Pipeline surveillance. Virtual pipeline technologies.

NGE 415: Natural Gas Technology Laboratory

Measurements of the thermal efficiency of simple gas furnaces. Comparisons of thermal efficiencies of small gas electric furnaces. Safety and control in furnace operation. Flow assurance experiments. Gas hydrate prediction measurements.

PEE 414: Petroleum Production Engineering

Multiphase flow in oil wells and surface facilities. Well Performance. Stimulation to remove damage. Surface production facilities designs. Fluid separation, storage, measurement, treating, custody transfer, transmission, disposal, corrosion, and other operations. Emulsion problems; oil emulsions; emulsifying agents and de-emulsifiers; choice and dosage of de-emulsifiers, heat treatment, heat treaters, desalting, oil storage and tank farms. Gauging, sampling and quality control. Underground storage. Water disposal. Corrosion. Water and injection systems.

PEE 416:Petroleum Refining Technology Processes 2 UNITS

Introduction; origin; formation and composition of petroleum. Introduction to Petroleum Refining Technology Processes. Refinery products; properties; significant tests and standard test methods; characterization and evaluation of crude oil stocks; generation of crude processing data; crude pre-heating and preliminary treatment; pipestill heaters; desalting; chemical treatment of refinery distillation; atmospheric and vacuum distillation; steam stripping; various arrangements of distillation towers. Number of trays calculation by various methods; various types of reflux employed; processing plans, schemes and product patterns of refineries. Modern separation, conversion and treatment processes; auxiliary processes and operations; refinery corrosion and metals; blending plants, product design and marketing. Petroleum refinery configurations.

NGE 416 Technical Seminar / Group Project

Review and presentation of advances in Natural Gas Engineering. Group Natural Gas project design and presentation.

500 LEVEL**NGE 510: Natural Gas Technology Process Control**

This course covers the basic concepts and techniques necessary to design, specify and manage gas field production facilities. It includes complete and up-to-date overview of gas conditioning and processing technology and provides a clear understanding of the equipment and processes used in common separation and gas treating systems. The course comprises selected industrial applications of industrial process systems and energy conversion processes, with emphasize on natural gas.

NGE 511: LNG and GTL Technologies

Refrigeration and liquefaction technologies, LNG production and processing, Ocean transportation and Storage. Peak Shaving and Base Load Storage. Boil off gas Production. GTL Production Technology. GTL Products: Methanol, FT Diesel, Dimethyl Ether, e.t.c. Review of Mathematical Concept Process Dynamic. Non-Linear Systems, Lumped Parameters, Feedback Control and Higher-level Control systems, Case Studies, Multi-variable control systems

NGE 512: Natural Gas Economics and Trade

Profitably analysis in oil and gas investments, inter-relation of technical and economic data, time value of money compound interest and annuity calculations depreciation methods, capital budgeting projects evaluations. Decline curves analysis, risk uncertainly in oil and gas exploration, decision tree analysis. Monte Carlo simulation, preference theory, pricing and bidding strategies, optimum field development, Nigerian Petroleum Profit Tax law. International Gas Market and Pricing Mechanisms.

NGE 513: Offshore Gas Production and Flow Assurance 3 UNITS

Offshore production. Sub-sea well completion methods; offshore processing equipment and design; loading systems and other transportation; multiphase pumping and metering. Offshore operations; logistics, contingency planning; environmental considerations, oil spill and oil removal, corrosion control. Flow Assurance Challenges, prediction and management; Hydrates formation; Scale; erosion etc.

NGE 514: Combustion Technology

Gaseous fuel combustion, Flame temperature calculations, diffusion and pre-mixed flame calculation, laminar flame, stability liquid and solid fuel combustion, atomization and spray combustion, review of mathematical concepts and process dynamics, non-linear systems, lumped parameters, feedback control systems.

NGE 515: Energy, Oil and Gas Laws

Basic elements and principles of petroleum law: National and International energy policies. Energy processing and distribution law. Energy pricing and politics. Renewable energy policy drive and its implication on the future energy development and climate change. Natural Gas Development, Natural gas policy, strategy and masterplan. Local content drive and challenges. Gas sector reforms in Nigeria, Downstream Natural Gas Legal and Regulatory Regime, Pipeline and other downstream licenses, Environmental issues, Social protection and responsibility issues, Safety and operational issues, Fiscal regime, Petroleum revenue management fund and sovereign fund arrangements.

NGE 520: Natural Gas Reservoir Modelling and Simulation 3 UNITS

Basic Principles of Reservoir Modelling. Modelling Gas, Oil and

Gas Condensate Reservoir. Numerical Techniques-Finite Difference Method, Finite Element, Method of weighted residuals, etc. Setting up a Simulation Study, data collection, fluid properties, etc. History Matching, Performance Prediction, Case studies, Specialized Applications, Water flooding, Gas Cycling, Infill Drilling, Miscible Flooding etc.

NGE 521: Natural Gas Handling, Processing and Safety 3 UNITS

Application of the concepts of thermodynamics and phase behavior in the processing and conditioning of natural and liquids. Absorption, adsorption and fractionation processing; gasoline plant design; liquefied petroleum gas (LNG); liquefied natural gas (LNG). Other sources of gas.

NGE 522: Unconventional Gas Technology

World energy resources, renewable and non-renewable energy sources, exploration and mining of such resources, types of unconventional gas sources: Landfill gas, shale gas, coal bed methane (CBM), tight gas reservoirs, Gas Hydrates, Biogas. Technologies for exploitation, production and processing. Environmental advantages/disadvantages of unconventional gas sources.

PEE 523: Production Enhancement & Optimization 3 UNITS

Natural flow analysis (Inflow Performance Relationship), wellbore performance (Vertical lift and Tubing Performance), surface flowline performance. Artificial Lift Methods. Well Stimulation: Acidizing, Hydraulic fracturing; sand exclusion techniques. Design and analysis of artificial lift methods of petroleum production; Nodal Analysis; Workover operations. Production optimization and forecast.

NGE 524: Software Application in the Gas Engineering 2 UNITS

Introduction to Process Simulation Using Software, Computer Application in all aspect of gas engineering, and Gas Production Facilities.

PEE 524: Integrated Field Development & Management 2 UNIT

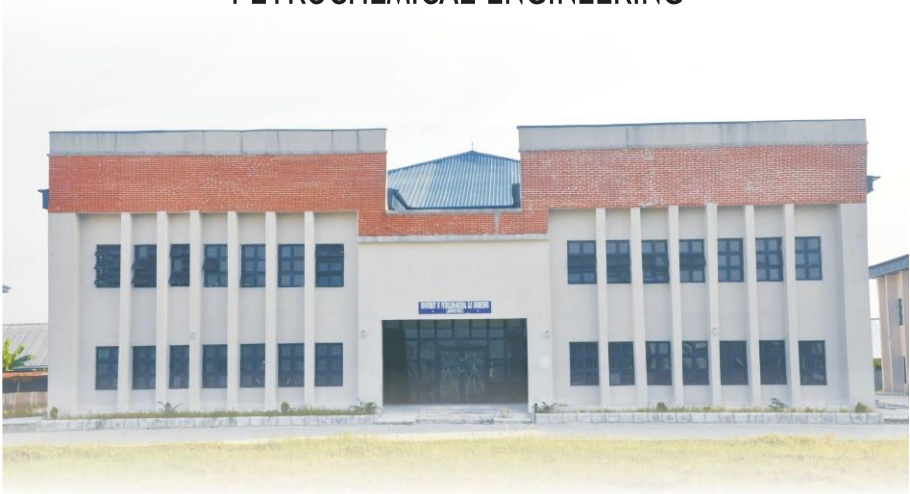
Review of basic concepts: exploration, appraisal, development. Elements of planning. Application to Green, Brown and Marginal oil fields. Gas field development. TECOP consideration. Development concepts and selection. Well planning. Synergy in petroleum asset management. Subsurface development realizations. Surface development options. Development sequence. Elements of project management. Risk register and risk management. Integrated operations philosophy and planning. HSE. Issues in Marginal and Gas Fields development and management. And compulsory field trip to any oil and gas facility.

NGE 598: Final Year Project and Seminar

Independent design and execution of a Natural gas engineering problem under a project supervisor. The project is selected from a list of projects at the beginning of the final year and work on the project continues throughout the final year. Student may suggest their own project. The project report must be type, bound and defended before the Departmental Academic Board and an external Examiner before graduation.

CHAPTER NINE

DEPARTMENT OF PETROCHEMICAL ENGINEERING



PETROCHEMICAL ENGINEERING LABORATORY

TITLE OF DEGREE PROGRAMME

This is the degree of Bachelors of Engineering (B.Eng.)

PHILOSOPHY

- The provision of training in theory and practice of engineering.
- To develop and provide engineering education geared towards the achievement of national goals and objectives of industrialization and self-reliance.
- Early introduction of students to entrepreneurial education and training.
- Acquisition of practical industrial experience for students by partnering with local industries in the execution of the Students Industrial Work Experience Scheme (SIWES) and Students Work Experience Programme (SWEP).

VISION

The Department of Petrochemical Engineering in FUPRE aspires to produce world class graduates/individuals who upon graduation are functional engineers that is versed in the theoretical principles and practical applications of the discipline.

MISSION

The Department of Petrochemical Engineering in FUPRE is out to:

- Empower her students with the requisite skills to add value and bring solutions to challenges in the

petrochemical plants, petroleum refining, chemical, and allied industries.

- Produce graduates who will be lead engineers in the country and internationally through well-designed training programme of teaching and research.
- Facilitate acquisition of practical work experience through collaboration with the petroleum refining, petrochemical, and other allied industries.
- Become a Centre for research relevant to the Petrochemical, Oil, Gas, Energy and other Allied industries in the country and the world at large.

OBJECTIVES

- The objective of the undergraduate programme is to educate future leaders in petrochemical engineering who effectively combine their broad knowledge of the basic sciences with their engineering analysis, refinery operations and design skills in bringing solutions to myriad of problems in petrochemical technology and in the synthesis of oil field chemical and products for oil and allied industry.
- Successful graduates upon graduation will be able to demonstrate their abilities to solve important petrochemical engineering problems in areas different from their training, and to develop new and valuable ideas in their professional careers.
- Participation of graduates on multidisciplinary teams assembled to tackle complex multifaceted problems that may require implementation of both experimental and computational approaches and a broad array of analytical tools.
- Ability of graduates to work in a variety of professional environments in both private and public sectors of the economy, this will be evidenced by their abilities to

work on teams or to work alone by providing leadership role, to mentor junior co-workers, and to effectively communicate amongst peers.

- Graduates will possess professional character which will be demonstrated by their ethical behaviour that can enable them pursuit professional registration, and their commitment to safety and the environment and including the concept of sustainable development, into petrochemical engineering practice.

CAREER OPPORTUNITIES

The graduates of Department of Petrochemical Engineering have career prospects in the following industrial sectors:

- Oil and gas industries
- Research and development organization
- Plastic industries
- Chemical Plants
- Equipment Suppliers
- Mineral Based Industries
- Oil Companies
- Pharmaceuticals
- Oil Production Companies
- Petroleum Refining Plants
- Oil Exploration Companies
- Petrochemical Plants
- Oil Field Services
- Petrochemical Engineering Consultancy

RATIONALE AND OUTCOME

The programme outcomes of the petrochemical engineering curriculum are as follows:

- Graduates will understand and be able to analyze entire petrochemical processes.

- Graduates will be proficient in the oral and written communication of their work and ideas.
- Graduates will be proficient in the use of computers, computer programming language relevant to petrochemical industry, and computer-based information systems.
- Graduates will have the ability to learn independently but will also be able to participate effectively in a team work.
- Graduates will be able to effectively design laboratory experiments, to design and simulate a petrochemical plant, to perform laboratory experiments, gather and analyze data, and test theories.
- Graduates will be able to understand their professional and ethical responsibilities as it relates to their profession.
- Graduates will understand the safety and environmental consequences of their work as petrochemical engineers and be able to design safe processes.
- Graduates will have the broad education necessary to understand the impact of engineering solutions in a society, national, and global context.

ADMISSION REQUIREMENTS

To be eligible for admission into the degree programme, all applicants must satisfy the minimum entrance requirements stipulated in the UTME Regulations. That is, all applicants must possess a minimum of five (5) credit passes in either WAEC or NECO ordinary level English, Mathematics, Physics and Chemistry examinations, and any one of the following subjects: Further Mathematics, Biology, Agricultural Science, Fine and Applied Art, Economics, Geography and Technical Drawing at not more than two sittings. In addition, applicants must obtain

the minimum cut-off points in UTME and PUTME (or equivalent) for the degree programme in the same cluster of five subjects. For Direct Entry Admission: In addition to the above, at least a credit Level Pass in the Federal University of Petroleum Resources, Effurun Foundational programme. The subjects should include Physics, Chemistry and Mathematics. At least an Upper Credit Level Pass in the Ordinary National Diploma (OND) in chemical or petrochemical engineering awarded by National Board for Technical Education (NBTE) accredited Polytechnic.

COURSE CONTENTS FOR 300 - 500 LEVEL PROGRAMMES

300-LEVEL

FIRST SEMESTER						
COURSE CODE	COURSE TITLE	L	T	P	CREDIT UNIT	STATUS
CHE 311	Material and Energy Balance Calculations	2	1	-	3	C
PTE 311	Heat and Mass Transfer I	2	1	-	3	C
PTE 312	Chemical and Oil field Chemistry	1	1	-	2	C
PTE 313	Petrochemical Engineering Lab I	1	-	3	2	C
PTE 314	Petrochemical and Organic Synthesis	2	-	-	2	C
PTE 315	Petrochemical Processes I	2	-	-	2	C
PTE 316	Process Instrumentation and Control	2	-	-	2	C
GET 311	Engineering Mathematics III	2	1	-	3	C
MEE 317	Basic Safety in Engineering	1	-	-	1	C
TOTAL CREDIT UNITS					20	

SECOND SEMESTER						
COURSE CODE	COURSE TITLE	L	T	P	CREDIT UNIT	STATUS
CHE 321	Separation Processes I	2	1	-	3	C
PTE 321	Petrochemical Processes II	2	1	-	3	C
PTE 322	Petroleum Products and storage	2	-	-	2	C
CHE 323	Environmental Engineering	2	1	-	3	C

PTE 324	Petrochemical Engineering laboratory II	1	-	3	2	C
GET 321	Engineering Mathematics IV	2	1	-	3	C
GET 322	Technical Report Writing and Seminar	1	-	-	1	C
GET 399	Student Work Experience Programme (SWEP) III	-	-	-	3	C
TOTAL CREDIT UNITS					20	

400-LEVEL

FIRST SEMESTER						
COURSE CODE	COURSE TITLE	L	T	P	CREDIT UNIT	STATUS
CHE 410	Process Modeling and Simulation	1	-	3	2	C
CHE 411	Separation Processes II	2	1	-	3	C
CHE 415	Particulate Systems Analysis	2	-	-	3	C
PTE 411	Petrochemical Engineering Plant Utilities, Design, and Safety	2	1	3	2	C
PTE 412	Petrochemical Engineering Lab III	1	-	3	2	C
PTE 413	Polymer Science and Technology	2	1	-	2	C
PTE 414	Petrochemical Processes III	2	-	-	2	C
CHE 417	Thermodynamics Engineering	2	-	-	2	C
GET 411	Engineering Mathematics V	2	1	-	3	C
TOTAL CREDIT UNITS					21	

SECOND SEMESTER		
COURSE CODE	COURSE TITLE	CREDIT UNIT
GET 429	Student Industrial Work Experience Scheme (SIWES)	6
TOTAL CREDIT UNITS		6

500-LEVEL

FIRST SEMESTER						
COURSE CODE	COURSE TITLE	L	T	P	CREDIT UNIT	STATUS
PTE 511	Process Optimization Techniques	2	1	-	3	C
PTE 512	Process Dynamics and Control	2	1	-	3	C
PTE 513	Petrochemical Process	2	1	-	3	C

	Technology					
PTE 514	Heat and Mass Transfer II	2	1	-	3	C
CHE 515	Chemical Reaction Engineering	2	1	-	3	C
GET 511	Engineering Law	2	-	-	2	C
PTE 598	Final Year Project and Seminar	-	-	9	0	C
	ELECTIVE COURSES (ANY ONE)					
PTE 515	Reservoir Engineering	2	1	-	3	E
PTE 516	Technology of fossil fuel processing	2	1	-	3	E
TOTAL CREDIT UNITS					20	

SECOND SEMESTER						
COURSE CODE	COURSE TITLE	L	T	P	CREDIT UNIT	STATUS
PTE 521	Pollution Control in Process industries	2	-	-	2	C
PTE 522	Petrochemical Plant Design	-	-	4	4	C
PTE 523	Refining Process Technology	2	1	-	3	C
PTE 598	Final Year Project and Seminar	-	-	9	6	C
GET 521	Engineering Management	2	-	-	2	C
	ELECTIVE COURSES (ANY ONE)					
PTE 524	Corrosion Engineering	2	1	-	3	E
PTE 525	Natural Gas Engineering	2	1	-	3	E
TOTAL CREDIT UNITS					20	

COURSE DESCRIPTION

CHE 311: MATERIAL AND ENERGY BALANCE CALCULATIONS 3 UNITS
 Material balances. Program of analysis of material balances. Program of analysis of material balance problems with direct solutions. Material balances using algebraic techniques control surface and stage balance for open and closed system. Material balances involving condensation and vaporization phase phenomena. Energy balances. Concepts and units. Heat capacity. Calculation of enthalpy changes without change phase. Enthalpy changes for phase transition. General energy balance. Reversible process the mechanical energy balance.

Heat of reaction. Heat of solution and mixing combining material and energy balances; Application of fundamental concepts of mass and energy balances and mass transfer to unit operations in distillation. Simultaneous use of material and energy balances for the steady state. Energy balances for adiabatic and non-adiabatic process. Unsteady state material and energy balances.

PTE 311: HEAT AND MASS TRANSFER I 3 UNITS

Basic Laws of mass, momentum and energy transfer process and their relationships; Prediction of transport coefficients, simple problems involving dimensionless groups such as Re Sc, Pr, Boundary layer theory and turbulence; Navier stokes equation; Universal velocity profile, Eddy diffusion; Theories of Mass transfer; Mass transfer with chemical reaction; Interfacial mass transfer; Fluid flow; Flow in pipes and nozzles, open channels, Flow measurement devices; Pumps, Compressors, Valves and Piping; Fick's law.

PTE 312: CHEMICALS AND OIL FIELD CHEMISTRY 2 UNITS

Factors that affect the choice of production chemical including greener chemicals, Control of production chemicals for the oil and gas industry. Water and gas; scale; acid stimulation; sand; corrosion in production; gas hydrate; wax (paraffin wax); demulsifiers; foam; flocculants, biocides; hydrogen sulfide scavenger; oxygen scavengers; and drag reducing agents, hydrogen carbon terminology, definitions, classifications, properties and chemical composition and associated metals, and including natural gas properties. Chemistry of cementing process as it relate to casting and other applications. The equipment and procedures for evaluating drilling fluid performance, clay mineralogy and the colloid chemistry of drilling fluids. Chemistry associated with natural gas processing and separation techniques. Ideal gas laws and their effect on processing and separation. Chemistry of natural gas processing; oil and gas separation, conversion and finishing which includes physical properties and analytical analysis. Chemistry of crude

oil refining: distillation and separation, hydrogenation and dehydrogenation; thermal

PTE 313: PETROCHEMICAL ENGINEERING LABORATORY I 2 UNITS
Laboratory experiments designed to teach basic and advanced laboratory techniques and practices in chemical engineering, Errors in measurements of experimental results. Selected experiments in heat transfer, mass transfer, simultaneous heat and mass transfer, chemical reaction engineering, biochemical engineering, process dynamics and control.

PTE 314: PETROCHEMICAL AND ORGANIC SYNTHESIS 2 UNITS
Mechanisms, synthesis, and applications of organic reactions: Sulfonation, nitration, halogenation, oxidation, intermediate organic compounds, mechanism of polymerization. Production of petroleum chemicals from hydrocarbons, Polymerization of mono-olefins to low molecular compounds, Polymerization of olefins to high molecular compounds, Alkylation of benzene with olefins, Alkylation of phenols with olefins. Isomerization of hydrocarbons, Manufacture of synthetic rubber, Oxidation of hydrocarbons, Hydration of olefins and saponification of alkyl chlorides, Synthesis based on CO and acetylene, Use of ionizing radiation in petrochemical synthesis, Synthetic detergents from petroleum, Polymeric materials from petroleum. Production of hetero chain polymers, Inorganic chemical from petroleum e.g. Urea, H_2SO_4 , H_2 .

PTE 315: PETROCHEMICAL PROCESSES I 2 UNITS
Introduction; origin; formation and composition of petroleum; Refinery products; properties; significant tests and standard test methods; characterization and evaluation of crude oil stocks; generation of crude processing data; crude pre heating and preliminary treatment; pipestill heaters; desalting; chemical treatment of refinery distillation; atmospheric and vacuum distillation; steam stripping; various arrangements of distillation towers. Number of trays calculation by various methods; various types of reflux employed; Processing plans,

schemes and product patterns of refineries. Introduction to Petrochemical key concepts and production of petrochemicals from Methane, Methanol, Propylene etc. Introduction to petrochemical equipment.

PTE 316: PROCESS INSTRUMENTATION AND CONTROL 2 UNITS
Basic elements of process control: The process sensors, final control elements, the controller. Instrumentation Basics: Sensors, transducers instrumentation signals, transmitters, instrumentation dynamics, instrumentation noise. Process measurements and instruments: Temperature measurement, pressure measurement, flow measurement, valves and pumps. Process characteristics: First order process, higher order processes, process type.

MEE 317: BASIC SAFETY ENGINEERING 1 UNIT
Principles of general safety and safety education; home safety, safe working practices; electrical safety; mechanical hazards; chemical hazards; environmental hazards; safety in hazardous area; industrial safety and analysis; fire safety, personal protection and firearm safety; Road traffic and pedestrian safety; Occupational safety; Natural and man-made disasters; Health assurance.

CHE 321: SEPARATION PROCESSES I 3 UNITS
Introduction to separation processes; Binary distillation; Hydrodynamics of packed and plate columns; Continuous contact columns. Analytical and graphical methods for determining number of equilibrium stages: McCabe - Theiele, Ponchon-Savarit, Stripping factor, etc. Minimum reflux, total efficiencies to determine number of actual stages, Crystallization; Drying of solids and Multiple-effects evaporators.

PTE 321: PETROCHEMICAL PROCESSES II 3 UNITS
Chemical Composition of crude petroleum oil, classification

method, petroleum products properties and method of analysis, different unit operations in a refinery distillation Thermal and analytical cracking and catalytic reforming. Refining of different petroleum products by physical and chemical methods. Refinery equipment e.g. distillation columns, ovens, heat exchangers, extraction equipment and cracking and reforming units. Classification of petrochemicals, overview of the petrochemical products and methods of production. New technologies and advances in the key petrochemical processes: reactor design, catalysis, separation systems, etc. Advances in the techno-economical aspects of the basic petrochemical processes, Thermoplastics, Thermosetting, Engineering resins.

PTE 322: PETROLEUM PRODUCTS TRANSPORT AND STORAGE 2 UNIT

Transportation of crude oil: Pipelines; tankers - loading and unloading techniques, offshore loading systems, international regulations on tanker transportation. Custody transfer storage of crude oil tank farm operations - gauging, sampling, quality control, underground storage - caverns, porous rocks. Gas transportation: compressors, pipelines; liquefied natural gas transportation. Storage of natural gas; pressure tanks, re-injection in porous rocks, storage in caverns. Storage of LNG.

CHE 323: ENVIRONMENTAL ENGINEERING 3 UNITS

Pollution and the environment definitions and inter-relationship; natural and manmade pollution, the economics of pollution. Air pollution; Gaseous and particulate pollutants and their sources; effects on weather vegetation material and human health. Legislation relating to air pollution, methods of control of gaseous emission and destruction; cyclones inertia separators electrostatic precipitator bag filters. Wet washers etc., Dispersal from chimney sand methods of calculating chimney height; Flare stacks, water pollution; river pollution by industrial effluent, Legislation and standards for effluent discharge; Impurities in natural water and their effects, Brief survey of ecology and the effects of effluents in the

ecosystems; Treatment processes including precipitation flocculation, coagulation, sedimentation, clarification, and colour removal. Principles of biological treatment processes; cost of treatment; treatment for water re-use, ion exchange cooling water treatment. Land pollution; Disposal of solid wastes by incinerator and dumping, Possible future trends including conversion of solid wastes into useful material or energy. Treatment of other types of pollution; noise; Thermal and nuclear pollution.

PTE 324: PETROCHEMICAL ENGINEERING LABORATORY II 2 UNITS
Laboratory experiments in Kinetics and further experiment in Kinetics and further experiment thermodynamics and separation processes.

400 LEVEL

CHE 410: PROCESS MODELING AND SIMULATION 2 UNITS
Review of Programming Languages in Fortran, Q-basic, C++programming languages. Solutions of Chemical Engineering problems by Digital computers. Software Applications relevant to Chemical Engineering such as Aspen HYSYS; CHEMCAD; MATLAB; PIPSIM, etc.

CHE 411: SEPARATION PROCESSES II 3 UNITS
Distillation of multi-component mixtures; Extractive and azeotropic distillation; Solvent extraction; Multicomponent gas absorption; Leaching and extraction with immiscible solvents; Novel separation Process; Ion exchange and reverse osmosis; Humidification and Water cooling.

CHE 415: PARTICULATE SYSTEM ANALYSIS 3 UNITS
Particle-Fluid mechanics; Motion of single particles and drops in fluids; Terminal falling velocities; Thickener calculations; Centrifuging characteristics of a rotating fluid. Principles of separation by sedimentation, flocculation, filtration and centrifuging. Types of centrifuges. Flow of single fluid through

packed beds; Calculation of pressure drop, Counter-current and co-current flow of fluids through packed columns; Flooding and loading rates. Fluidization; Types of fluidization, calculation of minimum fluidization velocities. Factors influencing fluidization characteristics; Behavior of bubbles, Heat and mass transfer and chemical reaction in fluidized beds. Conveying principles of pneumatic and hydraulic conveyance; Flow of non-newtonian suspensions. Size reduction. Law of comminution. Particle size distribution and size analysis; selection of equipment; Atomization of liquids, size enlargement. Mixing of fluids and solids; power requirements and selection of equipment.

**PTE 411: PETROCHEMICAL ENGINEERING PLANT UTILITIES,
DESIGN AND ECONOMICS 3 UNITS**

Product blending, supporting processes and gas recovery systems, Process design principles, sources of design data; Design of atmospheric, vacuum, and pressure columns for petroleum fractionation, including furnaces and condensers, design of efficient heat exchanger networks and utility systems, storage tanks, absorption tower. Piping and instrumentation, Costing and project evaluation. Presentation and discussion of real process design problems; process and engineering flow diagram; process outline charts incorporating method study and critical examination; mechanical design of process vessels and piping. Petroleum refinery economics and safety consideration: petroleum products production costs for different refinery configurations; cracking catalyst, petroleum refinery waste treatment. Environmental consideration; Site considerations; Costing of design process.

PTE 412: PETROCHEMICAL ENGINEERING LABORATORY III 2 UNITS

Laboratory experiments in process instrumentation, heat transfer and further experiments in separation processes, mass transfer, thermodynamics and particulate mechanics.

PTE 413: POLYMER SCIENCE AND TECHNOLOGY 2 UNITS

Introduction to polymer and their characteristics source of

monomers, structure and physical properties of polymers; 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.

PTE 414: PETROCHEMICAL PROCESSES III 2UNITS

Technology of organic processes, hydrogenation; alkylation; suphonation, nitrogenation and chlorination of various hydrocarbons, optimum operating conditions, thermodynamics of the reactions involved in each case; selectivity of catalyst used and requirements for optimum yields, production of paraffins; olefins and aromatics from petroleum, separation and purification techniques of reaction products from reactors, Manufacture of styrene, alkylbenzene, sulphonate and sodium esterification reactions and condensation reactions.

CHE 417: THERMODYNAMICS ENGINEERING 2 UNITS

Phase Equilibria; Criteria of equilibrium; Fugacity of pure component; General Fugacity relations for gases; Fugacity of gas mixtures, Effects of temperature and pressure on fugacity, Pressure temperature composition relationship; Phase behavior at low and elevated pressure, Raoult's law, Henry's law, Equilibrium constant; Activity coefficient; Gibbs-Duhem equation; Margules and Van Leer equations. Chemical reaction Equilibria; Standard free energy change and equilibrium constant. Evaluation of equilibrium constants. Effects of temperature and pressure on equilibrium constants; 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 of reaction.

Heats of mixing and solution, Enthalpy concentration diagrams, Partial enthalpies, Thermodynamics of flow processes. Fundamental equations, continuity equation; equation of motion; energy equation; Bernoulli's equations.

500 LEVEL

PE 511: PROCESS OPTIMIZATION 3 UNITS
Stationary optimization-Differential approach, Numerical approach, Linear and non-linear programming, Trajectory optimization single and multivariable feat techniques; constrained optimization techniques; Discreet events; Network analysis and queuing theory.

CHE 512: PROCESS DYNAMICS AND CONTROL 3 UNITS
Introduction to process dynamics and control; Review of mathematical tools needed for modeling and simulation, Process dynamics, review of laplace transforms; transient behavior of 1st, 2nd and higher order systems; Process control, Basic components of the process control system and their characteristics, closed loop transient response, Stability analysis/Frequency response Analysis; Design of feedback controllers based on frequency response criteria; Design of model based controllers such as IMC, DMC etc.

PTE 513: PETROCHEMICAL PROCESS TECHNOLOGY 3 UNITS
Overview of the chemical industry with examples cited. Industrial Water Supply and Waste-Water Treatment: Sources of water, test on water and wastewater. Clarification, softening, de-ionization and desalination. Treatment of water/waste-water. Industrial inorganic chemicals. Raw materials, technical and economic principles of processes and routes to products. Flow diagrams, selection from sulphuric acid, phosphoric acid, ammonia, nitric acid and fertilizers, salt, chlorine and sodium hydroxide; aluminum, iron and steel; tin, cement and glass. Hydrogen and carbon monoxide: synthesis gas oxo process, water gas, sources of hydrogen and its possible future uses. Industrial Organic Chemicals: Raw materials, technical and economic principles of processes and routes to product. Flow diagrams. Sugar technology, paints and varnishes; plastics. Evaluation of Process: Basic considerations,

economic feasibility, technical feasibility and other considerations. Chemical patents and trademarks: legal requirements, patent structure and language, etc. Research and Development (R & D): Function of R & D, process improvement; process development, etc.

PTE 514: HEAT AND MASS TRANSFERS II **3UNITS**

Nature of processes of conduction, convection and radiation; definition of thermal conductivity and heat transfer coefficients. Conduction through materials with constant and varying heat transfer areas; unsteady state conduction solution of equations for simple cases' Schmidt's methods. Principles of free and forced convection, determination of film transfer coefficient, Radiation; Kirchoff's and Stefans law, Emissivity, calculation of net heat exchange between bodies; multiple reflection and radiation methods. Radiation from gases. Heat transfer to boiling liquids; types of boiling and influence of conditions on heat fluxes and transfer coefficients. Heat exchanger design.

CHE 515: CHEMICAL REACTION ENGINEERING **3 UNITS**

Fluid mixing and residence time distribution; Fluidized bed, trickle bed and slurry reactors. Factors affecting choice of reactors; Reactor design calculations under isothermal and non - isothermal conditions; Characterization of catalysts; Rate controlling regimes in gas solid reactions catalyzed by porous catalyst effectiveness factor scale up procedure catalyst decay and reactivation.

PTE 515: RESERVOIR ENGINEERING **3 UNITS**

Activities in Reservoir Engineering. Technical responsibilities of the Reservoir Engineer. Principles of reservoir engineering. Basic Reservoir data, rocks and fluid properties (PVT, porosity, permeability, specific surface of rocks, compressibility of rocks and fluids, etc.).

Applications of reservoir fluids characteristics, material balance equations, specific types,

Application to gas and condensate reservoirs; general drive mechanisms in reservoir systems. Calculation of Stock Tank Oil Initially in Place (STOIP). Feed Unitisation and equity determination of Oil Initially in Place (OIIP). Recoverable resources. Property of oil field water, gas hydrate and their prevention. Phase behaviour and PVT properties of dry, wet and retrograde condensate natural gases as well as volatile and black oils. Moveable oil. Calculation of Gas Initially in place (GIIP). Material balance analyses of reservoir drives; Secondary recovery by water/gas injection. Water influx theory. Natural Gas Wells. Deliverability of gas reserves; Material balance, Pressure decline curve. Field Development planning and execution.

PTE 516: TECHNOLOGY OF FOSSIL FUEL PROCESSING 3 UNITS

Combustion fundamentals; properties of fuels (gaseous, liquid and solid fuels). Chemical kinetics and combustion thermodynamic, operating conditions, and furnace design impact on environment and operational performance such as emissions (NO_x, Sox, soot). Source, availability and characterization of fossil fuel (Petroleum, Natural gas, tar sands, coal). Modern processing technology: Choice of product lines and products: Alternative product lines and products specification to be emphasized.

PTE 598: FINAL YEAR PROJECT AND SEMINAR 6 UNITS

Student's individual final year research project under the supervision of an academic staff. The project should be on industrial problems that are significant to the national economy and may be design problems involving the study of processes. It should consist of preparation of flow sheet and heat and mass balances of the process

and a detailed design of plant or unit operating equipment used in the process. Due consideration must be given to safety.

Each student is expected to submit and orally defend a bound copy of technological/engineering design project. A design project should consist of introduction, literature review, process design, detailed design of some of the units of the process, specification of the equipment required, specification of materials of construction, basic mechanical design and drawings, inclusion of process control, modern drawings of the process equipment including a good flow chart, economic and environmental considerations.

PTE 521: POLLUTION CONTROL IN PROCESS INDUSTRIES 2 UNITS

Environmental impacts of industrial pollution; 2environmental quality standards; industrial waste water treatment; control methods of particulates and gaseous emissions, solid waste management; handling and disposal methods of hazardous wastes;; concept of waste recovery, recycle and minimization. Plant safety concepts. Hazards in chemical process industries, safety in plants, causes of accidents in process plants, prevention of accidents. HAZOP techniques. Maintenance of plants to minimize losses, waste disposal and effluent treatment, pollution control, legal implications of various losses. Introduction; safe work practices; personal protective equipment and costumes; electrical safety; mechanical hazards; chemical hazards; environmental hazards; safety in hazardous area; industrial safety and analysis; fire prevention and fire-fighting systems; building design and fire protection; first aid.

PTE 522: PETROCHEMICAL PLANT DESIGN 4 UNITS

Students are divided into groups. Each group is assigned a petrochemical engineering design problem involving the study of a process. Each group is allowed two months to complete the design project. The project will involve the choice and preparation of process flowsheet, calculation of material and energy balances, equipment selection and specification, detailed design of some plant items, plant layout and

instrumentation, economic analysis and safety considerations.

PTE 523: PETROLEUM REFINING TECHNOLOGY 3 UNITS

Introduction: Hydrocarbon chemistry; crude oil properties, sources and assay; refinery flow sheet Refinery distillation: crude desalting; atmospheric distillation, vacuum distillation. Gasoline manufacturing processes: Catalytic processes; brief description; catalytic cracking; catalytic reforming; hydrogenation processes; hydrogen cracking, fluid catalytic cracking; Alkylation; C5/C6 normal paraffin isomerization. Hydrogen production and recovery: steam reforming; partial oxidation, residium processing: delayed coking; Visbreaking. hydroprocessing: Distillate hydrotreating; hydrocracking processes. Gasoline manufacture process Petroleum processing equipment; storage tanks; rectification columns; heat exchange apparatus; pipe furnaces; pipelines and fittings; compressors and pumps. Preliminary processing. Thermal processes; thermal cracking; coking; pyrolysis.

PTE 524: CORROSION ENGINEERING 3 UNITS

Introduction to various forms of corrosion: direct corrosion, electrochemical corrosion, liquid metal corrosion types:

oxidation, oxide films, scale formation. Internal oxidation corrosion and electrode potential, corrosion rates. Combating corrosion. Protective coating, cathodic and anodic protection. Proper design and selection of materials.

PTE 525: NATURAL GAS ENGINEERING 3 UNITS

Composition of Natural Gas. The Natural Gas Industry. Application of the concept of thermodynamics, transfer phenomena and phase behaviour in the conditioning and processing of natural gas and its liquids, adsorption, absorption and fractionation processing. LPG, LNG system. Design of natural gas facilities-pressure losses in pipes. Pressure losses in armature and fitting GSE. Pumps, Nozzle theory and mass transfer. Dehydration; Need for dehydration of gas; Dew point

depression; Absorption with glycol and adsorption with solids; Sulphur removal; Scale problems. Control of gas quality. Adsorption facilities. Fractionation and heat exchanger design. Gas Storage. Wellhead Equipment and gathering systems. Flow of Natural Gas:

Field Compression. Static and Flowing bottom hole pressures calculations. Gas hydrates, hydrogen sulphide. Gas flow measurement: orifice meter, critical flow prover; Absolute open flow potential. Gas Transportation in Offshore Environment.

CHAPTER TEN

DEPARTMENT OF

PETROLEUM ENGINEERING



PETROLEUM ENGINEERING LABORATORY

10.1 TITLE OF DEGREE PROGRAMME

This is the degree of Bachelors of Engineering (B.Eng.)

10.2 COURSE PHILOSOPHY, AIMS AND OBJECTIVES

Petroleum Engineering involves the application of basic science, engineering and geology skills to the optimal production and processing of oil, gas, condensates and related substances. Petroleum engineers supervise and improve drilling and petroleum producing operations. They study and understand geologic and engineering principles to predict maximum oil and gas recovery, ultimate production and production rates.

Petroleum engineers are employed in a wide range of occupations as well-log analysis, drilling engineers, production engineers or reservoir engineers is responsible for finding oil and gas, designing and drilling the well as cheaply as possible. The production engineer analyzes and optimizes the performance of the individual wells, to determine how to bring the fluid to the surface and to develop a system of surface and to develop a system of surface equipment that's separates oil, gas and water. Reservoir engineers determine the fluid and pressure distributions throughout the reservoir, the natural energy sources available, the methods to recover the maximum amount of oil or gas from the reservoir.

The Bachelor of Petroleum Engineering is a five year program of study with a strong foundation in mathematics, physics and geology established during the first two years. In later years the emphasis is divided between the technical aspects of petroleum engineering – drilling, reservoir characterization, rock properties and geosciences, and management skills: economics, risk evaluation and decision making

10.3 ADMISSION REQUIREMENT

To be eligible for admission into the degree programme, all applicants must satisfy the minimum entrance requirements stipulated in the UTME Regulations. That is, all applicants must possess a minimum of five (5) credit passes in either WAEC or NECO ordinary level English, Mathematics, Physics and Chemistry examinations, and any one of the following subject: Further Mathematics, Biology, agricultural Science and Technical Drawing, Economics, Geography and Fine and Applied Art. In addition, applicants must obtain the minimum cut-off points in UTME and PUTME (or equivalent) for the degree programme in the same cluster of five subjects.

STAFF PROFILE

ACADEMIC STAFF FOR THE PROGRAMME

S/N	NAME	DISCIPLINE	AREA OF SPECIALIZATION	QUALIFICATION	RANK
1.	Prof. E. G. Imeakparia	Petroleum Geology	Petroleum Geology, Geophysics and Petrophysics	Ph.D, M.Sc, B.Sc; NAPE, MSPE	Professor
2.	Engr. Prof. C. N. Owabor	Chemical Engineering	Process & Petrochemical	Ph.D, (Chem. Engn.), M.Eng, (Chem. Engn) PGD(Chem. Engn). B.Sc. (Biochemistry); COREN, MNSE	Professor
3.	Dr. Juliet Emudianughe	Petroleum Geology	Petroleum Exploration	Ph.D, M.Sc, B.Sc.; MNAPE, MSPE.	Reader

4.	Engr. Dr. T. C. Nwaoha	Marine	LNG & Offshore Engineering System Risk	Ph.D(Marine & Offshore Engr), M.Eng(Marine & Offshore Engr), B.Eng. (Mech. Engr); COREN	Reader
5.	Engr. Dr. E. U. Jegbefume	Petroleum Engineering	Production Engineering & Petroleum Economics	Ph.D(Pet. Engr), M.Sc(Pet. Engr), B.Eng.(Chem. Engr); COREN, MSPE	Senior Lecturer

6.	Engr. Dr. Peters E. Akpoturi	Petroleum Engineering	Reservoir & Drilling Engineering	Ph.D (Pet. Engr), M.Sc, (Envi.Sc.) M.Eng (Pet. Engr), B.Eng.; C OREN, ESN, MSPE	Senior Lecturer
7.	Dr. Jerry Osokpor	Petroleum Geology	Petroleum Exploration	P.h.D., M.Sc., B.Sc.	Senior Lecturer
8.	Dr. G. Alaminiokuma	Petroleum Geophysics	Well Logging and Interpretation, Formation Damage and Rock Mechanics	Ph.D, M.Sc, B.Sc; NAPE, MSPE	Senior Lecturer
9.	Engr. Dr. P.W. Igbagara	Chemical Engineering	Separation Processes, Engineering Law	Ph.D(Chem. Engr), M.Sc(Chem. Engr), B.Sc.(Biochem); COREN, MNSE	Senior Lecturer
10.	Engr. Dr. A. Okewale	Chemical Engineering	Separation Process	Ph.D(Chem); M.Sc(Chem. Engr), B.Sc.(Chem. Engr); COREN, MNSE, MNSCHE	Senior Lecturer
11.	Engr. Dr. Akinwumi Akinade	Petroleum Engineering	Reservoir Engineering	Ph.D(Pet. Engr), M.Sc(Pet. Engr), B.Sc.(Chem. Engr); COREN, MNSE, MSPE	Senior Lecturer
12.	Engr. Dr. Wilfred C. Okologume	Petroleum & Gas Engineering	Production Engineering & Gas Utilization	M.Eng (Pet. & Gas Engr), B.Eng(Pet. Engr).; COREN, MNSE, MSPE, MIAENG	Lecturer 1

13.	Engr. Dr. Sylvester Okotie	Petroleum & Gas Engineering	Reservoir Engineering	M.Eng(Pet. & Gas Engr), B.Sc. (Pet. Engr); COREN, MSPE	Lecturer I
14.	Engr. Ogbarode N. Ogbon	Petroleum Engineering	Drilling & Gas Engineering	M.Sc. (Pet. Engr), B.Sc(Pet. Engr).; MSPE	Lecturer II
15.	Engr. Samuel Ofesi F.	Petroleum Engineering	Drilling Engineering	M.Eng, (Pet. Engr) B.Eng. (Pet. Engr); COREN, MSPE, MIAENG	Lecturer I
16.	Mr. Paul O. Okpozo	Petroleum Engineering	Reservoir Engineering	M.Eng, B.Eng, MSPE	Lecturer II
17.	Mr. Umar Ukkasha	Oil & Gas Engineering	Gas Engineering	B.Sc. (Oil & Gas. Engr)	Graduate Assistant

10.4.2 TECHNICAL STAFF FOR THE PROGRAMME

S/ N	NAME	DISCIPLINE	SPECIALIZATION	QUALIFICATION	RANK
1	Miss A. O. Ovuema (Engr. Tech.)	Petroleum Engineering	Production and Engineering	HND, B.Eng., MSPE, MNISP, MNATE, COREN.	Senior Technologist
2	Engr. Henry Idudje	Petroleum Engineering	Gas/Production	M.Sc, B.Eng, MNSE, MSPE, COREN	Senior Lab. Technologist
3.	Mr. Gift Pepe Neminebor (Engr. Tech)	Petroleum Engineering	Drilling/Production	HND, MNATE, COREN.	Technologist I
4.	Mr. Splendour U. Esidje	Petroleum Engineering	Reservoir	HND, B.Eng., MISP	Technologist I

10.4.3 ADMINISTRATIVE STAFF FOR THE PROGRAMME

S/N	Name	Qualifications	Rank/Employment Status
1	Mrs. Nwachukwu B. Endurance	B.Sc., Political Science	Admin. Secretary
2	Mrs. Kowho Cynthia	B.Sc., Business Education	Admin. Officer

UNDERGRADUATE COURSE CONTENT FOR 200-500 LEVELS

FIRST SEMESTER						
COURSE CODE	COURSE TITLE	L	T	P	CREDIT UNIT	STATUS
EEE 211	Basic Electrical Engineering I	2	-	-	2	C
GET 211	Engineering Mathematics I	2	1	-	3	C
GET 212	Engineer - in - Society	2	-	-	2	C
GET 219	Engineering Laboratory I	-	-	9	2	C
MEE 211	Engineering Drawing I	-	-	3	2	C
MEE 212	Engineering Mechanics I	2	-	-	2	C
MEE 213	Basic Manufacturing Technology	2	-	-	2	C
MEE 214	Engineering Materials	2	-	-	2	C
MEE 215	Fluid Mechanics	2	-	-	2	C
MEE 216	Basic Thermodynamics	2	-	-	2	C
PEE 211	Introduction to oil & gas industry	1	-	-	1	C
TOTAL CREDIT UNITS					22	

SECOND SEMESTER						
COURSE CODE	COURSE TITLE	L	T	P	CREDIT UNIT	STATUS
CVE 221	Basic Civil Engineering	2	-	-	2	C
GET 221	Engineering Mathematics II	2	1	-	3	C
EEE 222	Information Technology in Engineering	2	1	-	3	C
GET 229	Engineering Laboratory II	-	-	9	2	C
MEE 221	Engineering Drawing II	-	-	3	2	C
MEE 222	Engineering Mechanics II	2	-	-	2	C
GET 223	Basic Workshop Practice	-	-	3	1	C
MEE 224	Strength of Materials I	2	-	-	2	C
PEE 221	Introduction to Petroleum Engineering	2	1	-	2	C

GET 299	Student Work Experience Programme (SWEP) I	-	-	-	2	C
TOTAL CREDIT UNITS					22	

FIRST SEMESTER

COURSE CODE	COURSE TITLE	L	T	P	CREDIT UNIT	STATUS
GSE	Entrepreneurial Studies	2	-	-	2	C
GET 311	Engineering Mathematics III	2	1	-	3	C
MEE 317	Basic Safety Engineering	1	-	-	1	C
PEE 311	Reservoir Rock & Fluid Properties	3	-	-	3	C
PEE 312	Basic Petroleum Economics	3	-	-	3	C
PEE 313	Thermodynamics & Phase Behaviour	3	-	-	3	C

PEE 314	Petroleum Geology	3	-	-	3	C
PEE 315	Petroleum Engineering Lab. I		-	3	1	C
TOTAL CREDIT UNITS					19	

SECOND SEMESTER

COURSE CODE	COURSE TITLE	L	T	P	CREDIT UNIT	STATUS
GET 321	Engineering Mathematics IV	2	1	-	3	C

GET 322	Technical Report Writing and Seminar	1	-	-	1	C
PEE 326	Oil & Gas Pollution Studies & Control	2	-	-	2	C
PEE 320	Transport Phenomena in Porous Media	2	-	-	2	C
PEE 321	Drilling Engineering I	3	-	-	3	C
PEE 322	Well Completion & System Design	3	-	-	3	C
PEE 324	Applied Geophysics and Petroleum Exploration	2	-	-	2	C
PEE 325	Petroleum Engineering Lab II		-	3	1	C
GET 399	Student Work Experience Programme (SWEP) II	-	-	-	3	C

TOTAL CREDIT UNITS					20	
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FIRST SEMESTER						
COURSE CODE	COURSE TITLE	L	T	P	CREDIT UNIT	STATUS
GET 411	Engineering Mathematics V	3	-	-	3	C
PEE 410	Applied Reservoir Engineering I	3	-	-	3	C
PEE 411	Reservoir Characterization & Static Modeling	2	-	-	2	C
PEE 412	Formation Evaluation I	3	-	-	3	C
PEE 413	Natural Gas Engineering I	3	-	-	3	C
PEE 414	Petroleum Production Engineering	3	-	-	3	C
PEE 415	Petroleum Engineering Lab III	-	-	3	1	C
PEE 416	Petroleum Refining Technology Processes	2	-	-	2	C
PEE 417	Petroleum Product Transport and Storage	1	-	-	1	C
TOTAL CREDIT UNITS					21	

SECOND SEMESTER		
COURSE CODE	COURSE TITLE	CREDIT UNIT
GET 429	Student Industrial Work Experience Scheme (SIWES)	6
TOTAL CREDIT UNITS		6

FIRST SEMESTER						
COURSE CODE	COURSE TITLE	L	T	P	CREDIT UNIT	STATUS
GET 511	Engineering Law	2	-	-	2	C
PEE 510	Well Testing & Analysis	3	-	-	3	C
PEE 511	Secondary & Enhanced Recovery Principles	2	-	-	2	C
PEE 512	Formation Evaluation II	2	-	-	2	C
PEE 513	Petroleum Property Evaluation & Management	3	-	-	3	C
PEE 514	Petroleum Engineering Analysis	2	-	-	2	C
PEE 515	Natural Gas Engineering II	3	-	-	3	C
PEE 516	Offshore Drilling & Production Operations	2	-	-	2	C
PEE 598	Final Year Project & Seminar	-	-	9	0	C
TOTAL CREDIT UNITS					19	

SECOND SEMESTER						
COURSE CODE	COURSE TITLE	L	T	P	CREDIT UNIT	STATUS
GET 521	Engineering Management	2	-	-	2	C
PEE 520	Natural Gas Processing	3	-	-	3	C
PEE 521	Drilling Engineering II	3	-	-	3	C
PEE 523	Production Enhancement & Optimization	3	-	-	3	C
PEE 524	Integrated Field Development & Management	2	-	-	2	C
PEE 526	Applied Reservoir Simulation II	3	-	-	3	C
PEE 598	Final Year Project & Seminar	-	-	9	6	C
TOTAL CREDIT UNITS					22	

200 LEVEL**PEE 221: INTRODUCTION TO PETROLEUM ENGINEERING 3 UNITS**

Global distribution of oil and gas reserves, Distribution of Energy and Hydrocarbons in Nigeria. Phases in the Petroleum Industry- exploration, drilling, production, refining and marketing. Units and dimensions. Field Units. The concept and basis of measurement and analysis of pressure, temperature, and other parameters. Material and energy balance technique - the control surface concept. Introduction to Petroleum Engineering Literature.

300 LEVEL**MEE 317: BASIC SAFETY ENGINEERING 1 UNIT**

Principles of general safety and safety education; home safety, safeworking practices; electrical safety; mechanical hazards; chemical hazards; environmental hazards; safety in hazardous area; industrial safety and analysis; fire safety, personal protection and fire arm safety; Road traffic and pedestrian safety; Occupational safety; Natural and man-made disasters; Health assurance.

PEE 311: ROCK AND FLUID PROPERTIES 3 UNITS

Reservoir rock properties, rock and fluid properties (interaction between rock and fluids), fluid properties. Elements of hydrocarbon reservoirs; Definition and measurement of the reservoir rock properties such as porosity, permeability (absolute and relative) and Darcy's law in porous media flow. Fluid saturations, compressibility and interfacial phenomena (surface energy, surface tension, energy of adhesion and cohesion, wettability and capillary, refractive index and electrical conductivity). Fundamental properties of multiple fluid saturated rocks; correlation between rock properties

PEE 312: BASIC PETROLEUM ECONOMICS 3 UNITS

Review of basic economic concepts, General principles of Mineral economics. Resource allocation. Oil concessions in Nigeria. Government participation; the Nigerian Petroleum Labour Market; Cash flow analysis, CAPEX, OPEX and UTC in petroleum industry; Fiscal regimes in petroleum industry; Marketing and Sales calculations. Investment analysis; Risk analysis and probability. Financing petroleum projects.

PEE 313: THERMODYNAMICS AND PHASE BEHAVIOR 3 UNITS

The P-V-T behaviour of pure substances; Equation of state for gases; The principle of corresponding state; Compressibility relations; reduced pressure; reduced 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, Gililand'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, Partial enthalpies, single and multiple effect evaporators with regards to heat effects. Thermodynamics of Flow Processes, Oil and gas formation volume factors, viscosity. The liquid state; Physical properties of liquids, Transport properties of liquids, types of liquids. Binary and multi component systems with emphasis on the production of crude oil, natural gasoline, condensate reservoir. Vapour-Liquid Equilibria calculations.

PEE 315: PETROLEUM ENGINEERING LABORATORY I 2 UNIT

Laboratory experiments in oil reservoir rocks and fluids such as porosity, permeability, capillary pressure.

PEE 314: PETROLEUM GEOLOGY 3 UNITS

Origin, occurrence, movement, accumulation and exploration of hydrocarbon fuels. Distribution of hydrocarbon deposits and fields. Geology and Petroleum Geology. The Earth Core and Crustal Rocks Sedimentary Rocks/Sedimentary Basin Analysis Petroleum Genesis and Habitat. Petroleum Reservoirs Petroleum Trapping Mechanism Seismology. Properties of Sedimentary rocks (texture, structure, composition). Reservoir Traps (Definition, classification, physical properties, fluid saturation before oil and gas trapping) Surface Geology Explorations (traces and shows of occurrences seeds) as sampling stratigraphy, mineralogy, tectonics and petrology. Geophysical methods (gravimetry, magnetometry, seismic and electro methods) Subsurface geological exploration (drilling, well logging, geomechanical methods) Map Elaboration: Structural maps, Isobar maps, Isochore maps, Isoperm maps, facies maps, paleo – relief maps, cross – section, profiles

collapse and burst; designing a casing string. Well completion types including single and dual string completions. Smart well completions. Sizing of Tubular Goods. Perforating. Fundamentals of Vertical Multiphase flow. Single and two-phase flow through the tubing, choke, flowline and surface facilities.

PEE 326: OIL & GAS POLLUTION STUDIES & CONTROL 2 UNITS

Causes of oil pollution; blowout; pipeline and flowline leakages, sour-gas production, sea transportation hazards. Need for oil spill prevention and control; Impact on the environment – ecology. Methods of control; mechanical, chemical and biological methods. Global pollution problems; Government regulations.

PEE 325: PETROLEUM ENGINEERING LABORATORY II 2 UNITS

Practice in well-control procedures. Measurement of drilling fluid properties: Mud weight, rheological and filtration properties. PH, Chloride and oil content determination, etc.

PEE 324: APPLIED GEOPHYSICS AND PETROLEUM EXPLORATION 2 UNITS

The physical methods involved in exploration for hydrocarbons and minerals. These tools include gravity, magnetic, seismic, electrical, electromagnetic, and radioactivity studies. All aspects of these methods including theoretical considerations, data acquisition, and data processing and interpretation, with the objective of locating concentrations of natural resources and defining their extent. Improved techniques for calculating gravity fields, the use of proton-precession and optically-pumped magnetometers, improved quality of seismic data, magnetotelluric as a practical exploration method, new electromagnetic exploration methods, the use of gamma-ray spectrometers in radioactive exploration, and improved well-logging techniques.

PEE 323: INTRODUCTION TO OIL AND GAS OPERATIONS 1 UNIT

Overview of the petroleum industry: its history, technical achievements, role in the global economy and future prospects (Global distribution of oil and gas reserves, Distribution of Energy and Hydrocarbons in Nigeria); A brief introduction to modern exploration,

production and processing operations as well as highlights of the petroleum industry in Nigeria and the Gulf Guinea.

GET399: STUDENT WORK EXPERIENCE PROGRAMME (SWEP) III 3 UNITS

On the job experience in Engineering chosen for practical working experience but not necessarily limited to the student's major (during the long vacation following 300 level).

400 LEVEL

PEE 410: APPLIED RESERVOIR ENGINEERING 3 UNITS

Basic reservoir volumetrics and planimetry in reserves estimation; material balance equations, specific types, Application to gas and condensate reservoirs; general drive mechanisms in reservoir systems. Material balance analyses of reservoir drives; Water influx theory.

PEE 411: RESERVIOR CHARACTERIZATION & MODELING 2UNITS

Introduction to subsurface mapping. Preparation of contours, isopach, structure maps, uses of well controls, faults and fault plane maps. Correlations of well logs for field map construction; Reservoir heterogeneityand methods of evaluation: Lorenz, Dykstra Parsons, etc. scaling criteria and network flow. Use of modern static modelling softwares.

PEE 412: FORMATION EVALUATION I 3UNITS

Well logging fundamental principles and technology. Qualitative analysis of conventional electrical logs. Introduction to modern well logging methods, engineering, and core-log integration. Quantitative interpretation of electric, sonic, and nuclear logs by overlay, cross-plot, and digital evaluation methods. Use of Combination logs, Cross plots. Computer processing of logs. Logging while drilling systems.

PEE 413: NATURAL GAS ENGINEERING I 3 UNITS

Composition of Natural Gas. The Natural Gas Industry. Natural Gas Well. Wellhead Equipment and Gathering systems. Flow of Natural Gas. Field Compression. Static and Flowing bottom hole pressures calculations. *Gas hydrates, hydrogen sulphide. Gas flow measurement, orifice meter;*

critical flow prover; Absolute open flow potential; Deliverability gas reserves; Material balance, Pressure decline curve. Gas pipeline and Plant Design. Gas Transportation in Offshore Environments.

PEE 414: PETROLEUM PRODUCTION ENGINEERING 3 UNITS

Multiphase flow in oil wells and surface facilities. Well Performance. Stimulation to remove damage. Surface production facilities designs. Fluid separation, storage, measurement, treating, custody transfer, transmission, disposal, corrosion, and other operations. Emulsion problems; oil emulsions; emulsifying agents and de-emulsifiers; choice and dosage of de-emulsifiers, heat treatment, heat treaters, desalting, oil storage and tank farms. Gauging, sampling and quality control. Underground storage. Water disposal. Corrosion. Water and injection systems.

PEE 415: PETROLEUM ENGINEERING LABORATORY III 2 UNITS

Laboratory experiments in Petro-Physics (Well Logging); Determination of saturations, Electrical Resistivity, Capillary pressure and other Mechanical Properties from core samples.

PEE 416: PETROLEUM REFINING TECHNOLOGY PROCESSES 2 UNITS

Introduction; origin; formation and composition of petroleum. Introduction to Petroleum Refining Technology Processes. Refinery products; properties; significant tests and standard test methods; characterization and evaluation of crude oil stocks; generation of crude processing data; crude pre-heating and preliminary treatment; pipestill heaters; desalting; chemical treatment of refinery distillation; atmospheric and vacuum distillation; steam stripping; various arrangements of distillation towers. Number of trays calculation by various methods; various types of reflux employed; processing plans, schemes and product patterns of refineries. Modern separation, conversion and treatment processes; auxiliary processes and operations; refinery corrosion and metals; blending plants, product design and marketing. Petroleum refinery configurations.

PEE 417: PETROLEUM PRODUCT TRANSPORT AND STORAGE 1 UNIT

Transportation of crude oil: Pipelines; tankers – loading and unloading techniques, offshore loading systems, international regulations on tanker transportation. Custody transfer storage of crude oil tank farm operations – gauging, sampling, quality control, underground storage – caverns, porous rocks. Gas transportation: compressors, pipelines; liquefied natural gas transportation. Storage of natural gas; pressure tanks, re-injection in porous rocks, storage in caverns. Storage of LNG.

GET 429: STUDENTS INDUSTRIAL WORK EXPERIENCE SCHEME (SIWES) 6 UNITS

Students are required to undertake a six (6) months practical industrial work experience in any relevant industries involving design, construction and testing of mechanical systems.

500 LEVEL**PEE 510: WELL TESTING ANALYSIS 3 UNITS**

Mathematical basis for pressure analysis. Theory and practice of pressure testing techniques. Principle of Superposition, Effects and duration of afterflow; Pressure drawdown and Build up analysis. Reservoir testing and performance analysis; pressure tests in gas wells. Practical aspects of design and performance of field tests; Coning of water and gas; effects of partial penetration. Type curves and Pressure derivatives. Introduction to horizontal well testing. Steady-state, pseudosteady-state, and transient state equations used to determine well and reservoir parameters used in formation evaluation; applications to wells that produce gas and liquid petroleum; Decline Curve Analyses techniques and production rate forecasting; Deliverability testing.

PEE 511: SECONDARY & ENHANCED RECOVERY PRINCIPLES 2 UNITS

Engineering appraisal of secondary recovery methods; *Waterflooding. Gas methods, Chemical methods, and thermal methods: steam stimulation; steam drive; in-situ combustion*. Emphasis on evaluation of field prospects, prediction of recoveries, and design of facilities. *Principles of displacement: rock properties, fluid properties in reservoir, phase behaviour; mobility ratio, displacement efficiencies - areal and vertical sweep efficiencies. Immiscible displacement, Buckley*

measurement systems; gas storage reservoirs and flow in porous media, tubing, and pipelines; phase behaviour of gas condensates. Pressure testing in gas wells.

PEE 516: OFFSHORE DRILLING & PRODUCTION OPERATIONS 2 UNITS

Offshore drilling; offshore prospecting, offshore rigs. Stationary and floating rigs; rig movement and stability. Drilling from a floating vessel. Subsea BOP stack; marine risers, subsea well head. Offshore Production: Subsea well completion methods, offshore processing equipment and design; loading systems and other transportation. Introductory treatment of Flow Assurance issues in deep waters operations. Offshore Operations: Logistics, Contingency planning; Oil spill and removal.

PEE 520: NATURAL GAS PROCESSING 3 UNITS

Application of the concept of thermodynamics, transfer phenomena and phase behaviour in the conditioning and processing of natural gas and its liquids, adsorption, absorption and fractionation processing. LPG, LNG system. Design of natural gas facilities-pressure losses in pipes. Pressure losses in armature and fittings. Pumps. Nozzle theory and mass transfer. Dehydration; Need for dehydration of gas; Dew point depression; Absorption with glycol and adsorption with solids; Sulphur removal; Scale problems. Control of gas quality. Adsorption facilities. Fractionation and heat exchanger design. Gas Storage.

PEE 521: DRILLING ENGINEERING II 3 UNITS

Advanced concepts in drilling including slim holes, under balanced drilling, directional drilling, air drilling, etc. Bit Hydraulics: Principles of two-phase flow in pipes; the general energy equation; Evaluation of friction losses. Single phase flow. Variables used in two phase flow. Flow patterns. Horizontal flow; Prediction of horizontal flow patterns. Flow through restrictions. Air and gas drilling; lifting capacity of fluid. Determination of pressure drop, horsepower, and torque. Drilling services contract. Control of kicks, pressure control and blowout prevention. A unified treatment of all aspects of well planning and the optimization of oil and gas drilling processes.

PEE 523: PRODUCTION ENHANCEMENT & OPTIMIZATION 3 UNITS

Natural flow analysis (Inflow Performance Relationship), wellbore performance (Vertical lift and Tubing Performance), surface flowline performance. Artificial Lift Methods. Well Stimulation: Acidizing, Hydraulic fracturing; *sand exclusion techniques*. *Design and analysis of artificial lift methods of petroleum production; Nodal Analysis; Workover operations. Production optimization and forecast.*

PEE 524: INTEGRATED FIELD DEVELOPMENT & MANAGEMENT 2 UNITS

Review of basic concepts: exploration, appraisal, development. Elements of planning. Application to Green, Brown and Marginal oil fields. Gas field development. TECOP consideration. Development concepts and selection. Well planning. Synergy in petroleum asset management. Subsurface development realizations. Surface development options. Development sequence. Elements of project management. Risk register and risk management. Integrated operations philosophy and planning. HSE. Issues in Marginal and Gas Fields development and management. And compulsory field trip to any oil and gas facility.

PEE 526: APPLIED RESERVOIR SIMULATION II 3 UNITS

Review of Types of mathematical models. Finite differences. Components of a simulator. Data gathering. Grid systems. Static modelling and geological inputs. Initialization. History matching. Forecasting. Introduction to compositional simulation. Making a simulation study with a simulation software.

PEE 598: FINAL YEAR PROJECT AND SEMINAR 6 UNITS

Independent design and execution of a petroleum engineering problem under a project supervisor.

CONCLUSION

The College of Technology was designed to produce high-level manpower for the Oil and Gas industry and its allied sectors and to equip its students with knowledge and skills necessary to become global leaders, researchers and entrepreneurs. The facilities of each of the five departments are seasoned professional in their respective fields. Students are advised and encouraged to develop strong mentor-mentee relationships with the faculty of their department in order to gain assistance during the course of their academic program and guidance in making crucial career choices. The College of Technology wishes you all the best in all your academic endeavors and look forward to introducing you to the world as engineering graduates and global leaders.