THE STUDENTS' HANDBOOK

OF THE

DEPARTMENT OF ELECTRICAL AND ELECTRONIC ENGINEERING

COLLEGE OF ENGINEERING AND ENGINEERING TECHNOLOGY

MICHAEL OKPARA UNIVERSITY OF AGRICULTURE UMUDIKE

PREFACE

Edict No. 48 of the Federal Government of Nigeria established the Michael Okpara University of Agriculture, Umudike in May 1993. In due course, it became clear that the mission of the Institution could not be properly achieved, neither could Agriculture be successfully developed nor meaningfully utilized in the industrialization, mechanization and sustenance of the nation without an accompanying College of Engineering. Thus in 2001/2002 academic session, the College of Engineering and Engineering Technology, came into existence with the establishment of the Department of Agricultural Engineering followed in quick succession by Departments of Electrical and Electronic Engineering, Civil Engineering and Mechanical Engineering in the 2003/2004 academic session. Computer Engineering took off in the 2004/2005 academic session and Chemical Engineering in the 2011/2012 academic session. These departments run 5-year degree programmes leading to the award of the Bachelor of Engineering (B. Eng.) degree. Presently, these Departments run Postgraduate programmes leading to Post Graduate Diploma Certificate; Master of Engineering (M. ENG) and Doctor of Philosophy (PhD) degrees in Engineering.

Engr. Dr. O. Onuba who started the College of Engineering was also the first Acting Head of the Department of Electrical and Electronic Engineering. In the year 2007/2008 academic session, Engr. Dr. L. U. Anih who was on Sabbatical Leave in the department was appointed the Acting Head of the Department by the Vice-Chancellor and was charged with overall responsibility of organization, coordination and supervision of the various academic activities and day-to-day running of the Department. The Department has two major options: 1. Electrical Engineering option and 2. Electronic Engineering option.

In 2008/2009 academic session the Department graduated its first set of students who were seven in number (three second class upper division and four second class lower division). Thereupon, the Department continued to grow in teaching and research facilities, staff strength and student enrolment.

In 2008/2009 academic session, Engr. Prof. O. I. Okoro led the Department as the Head of the Department. In this academic year, the Department recorded a rapid development in terms of procurement and refurbishing of equipment as well as physical infrastructures. By 2014, Engr. Dr. A. J. Onah was appointed acting Head of Department and was succeeded by Engr. Dr. L. I. Oborkhale, who superintended the 2015 COREN Accreditation. Engr. Dr. P. I. Obi took over as Acting Head of Department from Engr. Dr. L. I. Oborkhale and eventually handed over to him again. Engr. Dr. I. K. Onwuka succeeded Engr. Dr. L. I. Oborkhale in 2022.
In 2024, Engr. Dr. C. C. Awah was appointed the Acting Head of Department.

The Department was granted full Accreditation in its last COREN and NUC Accreditation Exercises. The Staff strength of the Department is: 5 Professors, 3 Associate Professors, 8 Senior Lecturers, 5 Lecturer I, 1 Lecturer II and 29 Faculty-shared Staff. Additionally, the Department has 12 Technologists and 5 Administrative Staff.

The department through its Staff works so hard in order to produce high quality Engineers with excellent Professional skills, good Character and enviable moral standard.

This handbook will undoubtedly guide the Students through their academic journey in the department of Electrical and Electronic Engineering, as well as in the University in general. Thus, we strongly recommend this handbook to all our Students.
On this note, I warmly welcome you to the department of Electrical and Electronic Engineering and wish you a successful Studentship.

Engr. Dr. C. C. Awah
Acting Head of Department, Electrical and Electronic Engineering

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SECTION 1

INTRODUCTION

1.1 Programme Overview

Overview

Electrical and Electronics engineers are involved in channelling natural resources into various end-uses such as in heating, lighting, home appliances, consumer products, computing, sensing, control and communication systems. Electrical and Electronic Engineering are principally concerned with the design, production and the use of systems, subsystems, components and devices whose operation depends on Electrical and Electronic Engineering effects.

They contribute to the development of systems and devices for power, instrumentation, measurement, communication engineering, management, manufacturing, transportation, etc. They are primarily concerned with the processes of generation, transmission, transformation, control and utilization of energy and/or information

The entire field of Electrical and Electronic Engineering has expanded rapidly in the last decades and now encompasses a wide range of professional activities. Because of its diversity, it is impossible for an Electrical and Electronic Engineering to be a specialist or expert in all the branches of the field. Normally, specialization is required in consonance with national goals and objectives, for self-reliance and rapid industrialization; graduates with easily identifiable and readily applicable expertise in appropriate areas are required.

The curriculum exposes students to the breadth of electrical and electronic engineering and allows them to pursue electives in several areas including electrical circuits, electronics, electrical power systems, communication systems, signal processing, control systems, electromagnetics, optics/devices, and computer engineering. Hence courses in:

1. Electrical circuits and electronics provide study of basic electrical devices – energy sources, resistors, inductors, capacitors, diodes, and transistors – and their interconnection in operational networks. Circuit analysis and design techniques cover both analogue and digital applications;
2. Power systems emphasize the design and applications of motors, generators, transformers, distribution systems, high-voltage devices and power electronics;
3. Control systems emphasize the design and application of circuits and systems to automatically monitor and regulate operation of devices, machines, and processes. Advanced technologies using digital control, intelligent processing, neural networks and programmable logic controllers are included;
4. Communication systems and signal processing cover concepts required for the characterization and manipulation of information-bearing signals, modulation systems, wireless networks, image processing and signal detection software and hardware. These courses provide instruction in the interaction, propagation and transmission of high frequency waves and signals through space and in conductors. Topics include grounding and shielding, antennas, microwaves and systems; and
5. Optics/devices provide a study of solid-state materials, electronic devices and optoelectronics. Applications are micro-fabrication, telecommunications, computing, instrumentation, lasers and fibre optics, sensing and smart technologies.

The department of Electrical and Electronic Engineering, College of Engineering and Engineering Technology, Michael Okpara University of Agriculture, Umudike currently offers courses leading to the Bachelor of Engineering with specialization in Electrical and Electronic Engineering Technology.

1.2 History of the Department of Electrical Electronic Engineering

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The Department was granted full Accreditation in its last COREN Accreditation Exercise during the 2015/16 academic session. The Staff strength of the Department is: 5 Professors, 1 Associate Professor, 10 Senior Lecturers, 5 Lecturer I, 1 Lecturer II and 29 Faculty-shared Staff. Additionally, the Department has 12 Technologists and 5 Administrative Staff.

Through selfless service and relentless efforts, the Department staff struggle extremely hard despite the prevailing economic state of the educational sector of the nation to ensure we produce Engineers who are not only sound academically, but equally can compete excellently with their counterparts in various universities within and outside the country.

SECTION 2
PHILOSOPHY AND PROGRAMME OBJECTIVES

2.1 Philosophy of the Programme

The general philosophy of the Electrical and Electronics Engineering (EEE) programme is in line with the institutional mandate of the College of Engineering and Engineering Technology of Michael Okpara University of Agriculture, Umudike, tailored to produce graduates with high academic and soft skills competence, capable to adequately participate, transform and impact on the Engineering and allied industries in consonance with National and Global community values, including National Policy on Industrialization, food security, and Self-Reliance. The graduates of the Engineering training program would be sufficiently grounded in the basic sciences and Engineering knowledge to cater for the Electrical and Electronic Engineering problems of the nation. They are envisaged to be in the fore-front of indigenous technology development of the nation, predicated on sound theoretical framework, inter-woven with sufficient practical exposure. The practical content of their training will be sufficiently adequate to make them self-reliant and job creators. The above philosophy entails:

1. Adequate exposure to foundation science and general studies courses.
2. Sufficient exposure to basic engineering and engineering technology techniques.
3. Exploring the importance of efficient and sustainable solutions for Electrical and Electronics Engineering challenges, such as achieving sustainable electricity generation, secure distribution, and intelligent communication systems;
4. Providing ample opportunity for practical application and project work as emphasized throughout the course; and
5. Special skills and in-depth study in the students' professional areas of specialization.
6. Producing EEE graduates of high academic and ethical standards with adequate practical exposure for self-employment as well as being of immediate value to industry and the community in general.

The above process involves among other things, lectures, tutorials, laboratories, Engineering/Technology workshop practices, design works and industrial attachments and visitations.

2.2 Mission

The mission of the Department is embedded in the mission of the University, and the mission of the University says: To provide high-quality practical training for students to become professionally competent and confident persons capable of self-employment, to develop environment-friendly and person-sensitive technologies, and to enhance the well-being of the people through extension services and other interventions.

2.3 Vision

The University has a vision to serve Nigeria and humanity through processes that will lead to the alleviation of hunger.

The **Vision** of the University encapsulates its original purpose and what used to be referred to as its Mission and Mandate. The rehearsing of this vision gives anyone associated with it the expectations of the Institution. The University aims to provide the knowledge base for achieving food security, hence its motto: **Knowledge, Food and Security**.

In addition to this, the department holds the following vision:

"To be a leading destination in the Sub-Saharan Africa for industrial solutions and manpower training and development in Electrical and Electronic Engineering processes leading to industrialization and food security."

2.4 Aim of the Programme

The aim of the programme is geared towards the realization of national needs and aspirations through manpower development and research.

2.5 Core Values

Excellence, Integrity and Truth, Commitment and Diligence, Respect, Fairness and Justice.

2.6 The Programme Educational Outcomes (PEOs)

The Programme's Educational Objectives are geared towards the realization of national needs and aspirations. They are also designed with consideration to the visions and missions of the University.

The minimum expectations on the graduates of the Electrical and Electronics Engineering Department embodies the PEOs, which are as in Table 2.1.

Table 2.1: Programme Educational Objectives

S/N	PEO
PEO1	Develop entrepreneurial skills and knowledge, with the spirit of self-reliance, so that they can set up their own businesses.
PEO2	Design, develop and produce innovative policies, products, and services for industrial growth and food security in Nigeria.
PEO3	Adapt and adopt indigenous technology in order to solve engineering and technological problems of the Nation.
PEO4	Function effectively both as an individual and as a team member or leader in diverse and in multi-disciplinary settings.
PEO5	Be thoroughly equipped for postgraduate studies.

2.7 Programme Outcomes and Graduate Characteristics

Programme Outcomes refers to the capabilities the graduates of the Programme are expected to acquire from the training provided by the Programme. The programme outcomes of the Department of Electrical and Electronic Engineering of Michael Okpara University of Agriculture Umudike are presented in table 2.2, showing also the relevant graduate characteristics.

Table 2.2: Programme Outcomes and Graduate Characteristics

S/N	Characteristic	Programme Outcome (Engineer Graduate Profile)
PO1	Engineering Knowledge	Apply knowledge of mathematics, natural science, computing and engineering fundamentals, and an engineering specialization as specified in K1 to K4 respectively (see Table 2.3) to develop solutions to complex engineering problems
PO2	Problem Analysis	Identify, formulate, research literature and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences with holistic considerations for sustainable development (K1 to K4)
PO3	Design/ development of sustainable solutions	Design creative solutions for complex engineering problems and design systems, components or processes to meet identified needs with appropriate consideration for public health and safety, whole-life cost, net zero carbon as

		well as resource, cultural, societal, and environmental considerations as required (K5)
PO4	Investigation	Conduct investigations of complex engineering problems using research methods including research-based knowledge, design of experiments, analysis and interpretation of data, and synthesis of information to provide valid conclusions (K8)
PO5	Modern Tool Usage	Create, select and apply, and recognize limitations of appropriate techniques, resources, and modern engineering and IT tools, including prediction and modelling, to complex engineering problems (K2 and K6)
PO6	The Engineer and the World	When solving complex engineering problems, analyse and evaluate sustainable development impacts* to: society, the economy, sustainability, health and safety, legal frameworks, and the environment (K1, K5, and K7).
PO7	Ethics	Apply ethical principles and commit to professional ethics and norms of engineering practice and adhere to relevant national and international laws. Demonstrate an understanding of the need for diversity and inclusion (K9)
PO8	Individual and Collaborative Team work	Function effectively as an individual, and as a member or leader in diverse and inclusive teams and in multi-disciplinary, face-to-face, remote and distributed settings (K9)
PO9	Communication	Communicate effectively and inclusively on complex engineering activities with the engineering community and with society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations, taking into account cultural, language, and learning differences.
PO10	Project Management and Finance	Apply knowledge and understanding of engineering management principles and economic decision-making and apply these to one's own work, as a member and leader in a team, and to manage projects and in multidisciplinary environments.
PO11	Lifelong learning:	Recognize the need for, and have the preparation and ability for i) independent and life-long learning ii) adaptability to new and emerging technologies and iii) critical thinking in the broadest context of technological change (K8)
PO12	Adapting Indigenous Technology and Local Materials in the agrarian communities	Apply engineering and technological principles to simplify, facilitate, modernize, and optimize traditional processes and methods in farming, harvesting, and food preservation; ability to employ locally sourced materials in providing engineering and technological solutions.

2.8 Knowledge Attribute Profile

The curriculum shall encompass the knowledge profile as summarised in the table below:

Table 2.3: Knowledge Attribute Profile

S/No.	Attribute
K1	A systematic, theory-based understanding of the **natural sciences** applicable to the discipline and awareness of relevant **social sciences**.
K2	Conceptually-based **mathematics**, numerical analysis, data analysis, statistics and formal aspects of computer and information science to support detailed analysis and modelling applicable to the discipline.
K3	A systematic, theory-based formulation of **engineering fundamentals** required in the engineering discipline.
K4	Engineering **specialist knowledge** that provides theoretical frameworks and bodies of knowledge for the accepted practice areas in the engineering discipline; much is at the forefront of the discipline.

K5	Knowledge, including efficient resource use, environmental impacts, whole-life cost, re-use of resources, net zero carbon, and similar concepts, that supports **engineering design and operations** in a practice area.
K6	Knowledge of **engineering practice** (technology) in the practice areas in the engineering discipline.
K7	**Knowledge of** the role of engineering in society and identified issues in engineering practice in the discipline, such as the professional responsibility of an engineer to public safety and sustainable development.
K8	Engagement with selected knowledge in the current **research literature** of the discipline, awareness of the power of critical thinking and creative approaches to evaluate emerging issues.
K9	**Ethics, inclusive behaviour and conduct**. Knowledge of professional ethics, responsibilities, and norms of engineering practice. Awareness of the need for diversity by reason of ethnicity, gender, age, physical ability etc. with mutual understanding and respect, and of inclusive attitudes.

The UN Sustainable Development Goals (UN-SDG) informed the development of these knowledge profiles.

2.9 Definition of Complex Problem Solving

The range of complex problem solving which the graduate of the programme must be capable of is defined as follows:

Table 2.4: Range of Complex Problem Solving

Attribute	**Complex Engineering Problems** have characteristic P1 and some or all of P2 to P7:
Depth of Knowledge Required	P1: Cannot be resolved without in-depth engineering knowledge at the level of one or more of K3, K4, K5, K6 or K8 which allows a fundamentals-based, first principles analytical approach
Range of conflicting requirements	P2: Involve wide-ranging and/or conflicting technical, nontechnical issues (such as ethical, sustainability, legal, political, economic, societal) and consideration of future requirements
Depth of analysis required	P3: Have no obvious solution and require abstract thinking, creativity and originality in analysis to formulate suitable models
Familiarity of issues	P4: Involve infrequently encountered issues or novel problems
Extent of applicable codes	P5: Address problems not encompassed by standards and codes of practice for professional engineering
Extent of stakeholder involvement and conflicting requirements	P6: Involve collaboration across engineering disciplines, other fields, and/or diverse groups of stakeholders with widely varying needs
Interdependence	P7: Address high level problems with many components or sub-problems that may require a systems approach

2.10 Definition of Complex Engineering Activities

The range of complex engineering activities is defined in Table 2.5. Complex engineering activities refer to activities or projects that have some or all the characteristics of Table 2.5.

Table 2.5: Range of Complex Engineering Activities

Attribute	**Complex Activities**
Preamble	**Complex activities** mean (*engineering*) activities or projects that have some or all of the following characteristics:

Range of resources	A1: Involve the use of diverse resources including people, data and information, natural, financial and physical resources and appropriate technologies including analytical and/or design software
Level of interactions	A2: Require optimal resolution of interactions between wide-ranging and/or conflicting technical, non-technical, and engineering issues
Innovation	A3: Involve creative use of engineering principles, innovative solutions for a conscious purpose, and research-based knowledge
Consequences to society and the environment	A4: Have significant consequences in a range of contexts, characterized by difficulty of prediction and mitigation
Familiarity	A5: Can extend beyond previous experiences by applying principles-based app

2.11 Careers and Opportunities

The graduates of the Programme are expected to, first and foremost, be job creators rather than job seekers.

There is a gamut of very broad opportunities for electrical and electronics engineers. Electrical and Electronics Engineers are involved in the design and development of electrical and electronics equipment and in the improvement of the capabilities of existing electrical and electronics equipment. They can also find themselves in software companies involved in the design, manufacture and operation of various engineering devices.

Major companies recruit skilled and capable Electrical and Electronics Engineers to accelerate their growth. However, graduates should also acquire practical knowledge in laboratory sessions and practical in order to be successful in the field. Interested graduates can also progress to the postgraduate level to obtain Masters and Doctorate degrees in any of the specialised areas of Electrical and Electronics Engineering, particularly if they desire to become lecturers and professors in the future. The graduates therefore can find themselves comfortably fixed in many types of work.

The career scope in this field at both national and international levels is excellent. Some of the job profiles which Electrical and Electronics Engineers usually work after graduation are shown in Table 2.6.

Table 2.6: Career Opportunities

Job Title	**Job Description**
Design Engineer	Development of ideas for new products and the systems used to manufacture them. Such systems include consumer electronics (TV, VCRs, CD players, stereo equipment, gaming devices); power generation, transmission and distribution; computer equipment (motherboards, printers, scanners, processors, monitors); communications equipment (transmitters and receivers, networks)
Electronics Engineer	Design and creation of everyday devices such as mobile phones and computers.
Manufacturing Engineer	Plant Engineering: servicing and offering support in industrial environment; Power Engineering: safe and reliable power delivery; Control Engineering: design, programming, support to industrial automation; Information Systems Engineering: support to manufacturing processes.
Quality Control Engineer	Designing and overseeing the production of various types of complex systems and equipment.

Analysis and Test Engineer	Plan, design, and evaluate products, as well as collaborating with the production department. Technical Service Engineering: troubleshooting, maintenance and repair; Product Testing for quality, safety, performance of equipment.
Software Engineer	Software engineers develop, test and improve systems and components including circuit boards, processors and other devices.
Project Engineer	Planning, implementing, resource forecasting and other technical activities of the project.
System Design Engineer	To research, study and develop new ideas for new products and the system to manufacture them.
Research Engineer	Analysing, implementing and testing the product developed in the laboratory
Field/Sales Engineer	Technical Service Engineering: troubleshooting, maintenance and repair; Product Testing for quality, safety, performance of equipment.
Research and Development (R&D)	Product Development; Research to discover/develop new technologies; Training

In addition to Table 2.6, employment opportunities exist in other area such as in oil industries, in shipping and banking industries, in general Management and Security Establishments, Government Ministries and parastatals, in Education and other Technological institutions.

Specifically, prospective employers of the graduates include Power Holding Company of Nigeria, Nigeria Telecommunications Limited and other IT Companies, manufacturing industries, Building and Construction Companies, Nigeria Ports Authority, Rural Electrification Boards, all Federal and States Ministries, all Oil Companies, Banks, Private Institutions, Security Organizations, Academia, etc.

Section 3
Admission and Graduation Requirements

3.1 Requirements and Process for the Admission of Students

The Department offers a five-year programme for the Bachelor of Engineering (B.Eng.) Honours Degree in Electrical/Electronic Engineering.

There are two modes of admission into the degree programme of Electrical Electronic Engineering department. The first is admission through the Universal Tertiary Matriculation Exam (UTME) organized by the Joint Admission and Matriculation Board. The second is by Direct Entry Admission through the Joint Admission and Matriculation Board.

i. The admission requirement for UTME candidates into the course is a minimum of 5 (Ordinary level) credit passes in West African Senior Secondary School Certificate (WASSSC), General Certificate of Education (GCE) or in National Examination Council Ordinary Level (NECO) in not more than two sittings. The credits must include English Language, Mathematics, Physics and Chemistry and any other relevant subject. The candidate must not be below 16 years of age. In addition, they must sit for the UTME with the following subject combination: English Language, Mathematics, Physics, and Chemistry.

   The Ordinary Level Results are combined with the UTME result in a Screening Exercise by the University Admission Board (UAB), through a matrix that determines the average score between the two exams. Attaining a mark that is not below the departmental cut off mark, which is determined by the UAB, becomes the basis of admitting the students into the Programme.

   UTME candidates are admitted into the 100 level of the programme.

ii. Direct entry admission is based on a combination of 'O' Level results with the following qualifications: (a) GCE or HSC ('A' Level two papers in Physics, Mathematics or Chemistry), (b) OND (Upper Credit), and (c) HND (Upper Credit).

   Candidates with qualifications as in (a) and (b) above may be admitted into the 200 level and those with the qualifications in (c) may be admitted into the 300 level. All candidates must meet the basic minimum requirement of 5 'O' Level credit passes in relevant subjects as specified in (i) above.

3.2 Graduation Requirement

To satisfy the requirements for graduation, a student must take and pass the minimum units specified in the programme before he/she can qualify for the award of a degree in Engineering or Technology. This includes passing all compulsory General Studies Courses and the Industrial Training courses within a minimum of 6 semesters (for Direct Entry with HND), or 8 semesters (for Direct Entry with OND and "A" Level), or 10 Semesters for UTME candidates).

SECTION 4
ACADEMIC MATTERS

4.1 CGPA Computation and Degree Classifications

Grading of courses shall be done by a combination of percentage marks and letter grades translated into a graduated system of Grade Point Equivalents (GPE). For the purpose of determining a student's standing at the end of every semester, the Grade Point Average (GPA) system shall be used. The GPA is computed by dividing the total number of credit points (TCP) by the total number of Credit Load (Units) (TCL) for all the courses taken in the semester. The credit point for a course is computed by multiplying the number of units for the course by the Grade Point Equivalent of the marks scored in the course.

Table 4.1 shows the letter grades and grade points that can be scored in a course. The determination of the class of degree is based on the Cumulative Grade Point Average (CGPA) earned at the end of the programme. The CGPA is used in the determination of the class of degree as summarized in Table 4.2.

Table 4.1 Grades and Grade points

Percentage score	70-100	60-69	50-59	45-49	40-44	0-39
Letter Grade	A	B	C	D	E	F
Grade point	5	4	3	2	1	0

Table 4.2 CGPA Computation and Degree Classification

CREDIT UNITS	**LETTER GRADE**	**GRADE POINTS (GP)**	**GRADE POINT AVERAGE (GPA)**	**CUMULATIVE GRADE POINT AVERAGE (CGPA)**	**CLASS OF DEGREE**
(i)	**(ii)**	**(iii)**	**(iv)**	**(v)**	**(vi)**
Credit unit vary according to the contact hours assigned to each course per week per semester and also according to work load	A	5	The Grade Point Average is derived by $\sum \frac{((i)\times(iii))}{total\ credit\ unit}$	4.50 – 5.00	1st Class
	B	4		3.50 – 4.49	2^1 Second Class Upper
	C	3		2.50 – 3.49	2^2 Second Class Lower
	D	2		1.50 – 2.49	3rd Class
	E	1		1.00 – 1.49	Pass
	F	0		0.00 – 0.99	Fail

4.2 Course Duration/Tenancy

The maximum length of time allowed to obtain a degree in the college shall be fourteen semesters for the 5-year degree programme and twelve semesters for students admitted directly into the 200 level. For extension beyond the maximum period, a special permission of Senate shall be required on the recommendation of the College Board.

4.3 Probation

A student whose Cumulative Grade Point Average is below 1.00 at the end of a particular year of study, earns a period of probation for one academic session. A student on probation is allowed to register for courses at the next higher level in addition to his/her probation level courses provided that: the maximum of 18 credit units per semester is not exceeded.

(a) The regulation in respect of student work-load is complied with; and
(b) The pre-requisite courses for the higher-level courses have been passed.

4.4 Withdrawal and Transfer of Students to other Programmes in the University

A candidate whose Cumulative Grade Point Average is below 1.00 at end of a particular year of probation should be required to withdraw from the University. However, in order to minimise waste of human resources, consideration is usually given to withdrawal from programme of study and possible transfer to other programmes within the University.

4.5 Transfer of Credits

Universities are enjoined to run comparable syllabi to enable students who transfer from one university to another transfer their credits wholly. Students who transfer from one programme to another within the University are also allowed to transfer all their credits relevant to the required courses in the new programme. The student should meet his course adviser to facilitate such transfer of credits.

4.6 Temporary Withdrawal

A student may apply to the Senate for a temporary withdrawal for a whole academic session if for any reason the student is not able to participate in academic activities for that particular session. Such reasons could be financial constraint, poor health, etc. For the reason of poor health, a medical report from a good hospital must be presented and certified by the University Medical Centre.

4.7 Waiver of Semester

A Student will be required to apply to the Chairman of Senate Business Committee for a waiver of any Semester in which he/she has no course to do. This will be subject to recommendations by the College Board.

4.8 Missed Exams

Where a student has a cogent reason to miss an exam, the student will be required to apply to the Chairman of Senate Business Committee for permission to retake the missed exam at the next available opportunity. Where the reasons are not cogent, the student would be required to retake the course as a failed course.

SECTION 5
MISCONDUCTS, SANCTIONS AND CONFLICT RESOLUTION

The various sanctions for Examination Misconduct and Other Related Offences as Approved by Senate of Michael Okpara University of Agriculture, Umudike at its 134th Regular Meeting Held on May 11, 2011. Are as follows:

Table 5.1 Misconducts and Sanctions

S/N	Offence/Misconduct	Sanction
1.	Communication with any Student in any manner, receiving assistance or giving assistance to another student(s) during examination.	Rustication for two (2) semesters; expulsion at repeat of same offence/misconduct.
2.	Impersonation in an examination	Expulsion for the impersonator and the impersonated
3.	Copying or reading from another student's answer script during an examination or opening one's script or material for another student to read or copy.	Rustication for two (2) semesters; expulsion at repeat of same offence/misconduct
4.	Bringing into the examination hall/room any unauthorized materials such as books, notes, papers, devices, phones, manuscripts.	Expulsion from the University
5.	Involvement in leaking examination question papers or any form of unauthorized handling of examination questions.	Expulsion
6.	Forging, altering or presenting medical report in order to obtain deferment of an examination or any other benefit	The culprit will face the Student Disciplinary Committee.
7.	Lobbying for examination grades by whatever means	The culprit will face the Student Disciplinary Committee.
8.	Involvement in any other form of cheating or other acts intended to confer undue advantage on the student.	Rustication for two (2) semesters; expulsion at repeat of same offence/misconduct.
9.	Aiding, abetting or covering examination misconduct by any student.	Rustication for two (2) semesters; expulsion at repeat of same offence/misconduct.
10.	Refusal to make a written statement or sign any of the materials to be used as exhibits in support of an examination misconduct.	Expulsion
11.	Refusal to appear before an examination misconduct or malpractice Committee/Panel	Expulsion
12.	Smuggling of examination question paper out of the examination hall/room while the examination is in progress	Expulsion
13.	Refusal to hand over suspected/incriminating materials	Expulsion
14.	Destruction of suspected/incriminating materials	Expulsion
15.	Failure to return in answer script after an examination	Rustication for two (2) semesters; expulsion at repeat of same offence/misconduct.
16.	Writing before the order to begin or after the student has been ordered to stop writing.	The Supervisor shall deduct 10 marks from the student's work.

For other offenses such as fighting, stealing, indecent dressing, promiscuity and other sexual offenses, insubordination, and inciting violence or rebellion to the management, the culprit will be made to face the Student's Disciplinary Committee.

Conflict Resolution

In the case of any victimization against any student, or extortion, or blackmail, or threat of any degree, or conflicts between a student and another student or other University Community members, the student is encouraged to approach his/her Course Adviser to make a complaint. If he/she is not satisfied with the response, the student may approach the Head of Department. Where the student still feels short changed, the student may approach the Dean of the College, or the Dean of Student Affairs if the matter is not resolved at the College.

For matters involving students' campus life, such complaints may be initiated with the Students' Government, to the Dean of Students Affairs.

SECTION 6
CURRICULUM

Table 6.1: Course Listing according to Semesters

100 LEVEL - FIRST SEMESTER					
Course Code	**Course Title**	**Units**	**Status**	**LH**	**PH**
GET 111	Engineer in Society	1	C	15	-
CHM 113	General Chemistry I	2	C	30	-
CHM 114	General Practical Chemistry I	1	C	-	45
MTH 112	Elementary Mathematics I	2	C	30	-
PHY 111	General Physics I	2	C	30	-
PHY 113	General Physics III	2	C	30	-
PHY 117	General Practical Physics I	1	C	-	45
STA 112	Probability 1	3	C	45	-
GST 111	Communication in English	2	C	15	45
GST 112	Nigerian People and Culture	2	C	30	-
LIB 116	Use of Library	1	C	15	-
IGB 111	Basic Igbo Literacy	1	C	15	-
FRE 114	Elementary French I	1	E	15	-
GER 115	Elementary German I	1	E	15	-
	Total	**20**		**255**	**135**
100 LEVEL - SECOND SEMESTER					
Course Code	**Course Title**	**Units**	**Status**	**LH**	**PH**
EEE 121	Introduction to Electrical and Electronics Engineering	2	C	30	-
GET 121	Design Thinking and Innovation	1	C	15	-
GET 122	Engineering Graphics and Solid Modeling I	2	C	15	45
GET 123	Engineering Laboratory I	1	C	-	45
CHM 121	General Chemistry II	2	C	30	-
CHM 124	General Practical Chemistry II	1	C	-	45
MTH 122	Elementary Mathematics II	2	C	30	-
MTH 123	Elementary Mathematics III	2	C	30	-
PHY 122	General Physics II	2	C	30	-
PHY 124	General Physics IV	2	C	30	-
PHY 127	General Practical Physics II	1	C	-	45
ENG 121	Use of English II	1	C	15	-
IGB 121	Readings and Practice in Igbo	1	C	15	-
FRE 124	Elementary French II	1	E	15	-
GER 125	Elementary German II	1	E	15	-
	Total	**20**		**240**	**180**

*E= Elective

200 LEVEL - FIRST SEMESTER					
Course Code	**Course Title**	**Units**	**Status**	**LH**	**PH**
GET 211	Applied Electricity I	3	C	30	45
GET 212	Engineering Graphics and Solid Modeling II	2	C	15	45
GET 213	Engineering Mathematics I	3	C	45	-
GET 214	Applied Mechanics	3	C	45	-
GET 215	Students Workshop Practice	2	C	15	45
GET 216	Fundamentals of Thermodynamics	3	C	45	-
ENT 211	Entrepreneurship and Innovation	2	C	30	-
GST 217	Philosophy, Logic and Human Existence	2	C	30	-
	Total	**20**		**255**	**135**

200 LEVEL - SECOND SEMESTER					
Course Code	**Course Title**	**Units**	**Status**	**LH**	**PH**
EEE 221	Applied Electricity II	3	C	30	45
EEE 222	Electrical Engineering Materials	3	C	45	-
GET 221	Computing and Software Engineering	3	C	30	45
GET 223	Engineering Mathematics II	3	C	45	-
GET 224	Strength of Materials	3	C	45	-
GET 225	Fundamentals of Fluid Mechanics	3	C	45	-
GET 226	Electrical and Electronics Engineering Laboratory	1	C	-	45
GET 227	Engineering Laboratory II	1	C	-	45
*GET 299	SIWES I	3	C	9 WEEKS	
	Total	**20**		**240**	**180**

* **All SIWES credited in the 2nd Semester of 400-Level**

300 LEVEL-FIRST SEMESTER					
Course Code	**Course Title**	**Units**	**Status**	**LH**	**PH**
EEE 311	Electromagnetic Fields and Waves I	2	C	30	-
EEE 312	Electric Circuit Theory I	2	C	30	-
EEE 313	Electrical Machines I	2	C	30	30
GET 311	Engineering Statistics and Data Analytics	3	C	45	-
GET 312	Introduction to Artificial Intelligence, Machine Learning and Convergent Technologies	3	C	45	-
GET 313	Engineering Mathematics III	3	C	45	-
GET 314	Engineering Laboratory III	1	C	-	45
ENT 312	Venture Creation	2	C	15	45
GST 312	Peace and Conflict Resolution	2	C	30	-
	Total	**20**		**270**	**120**
	300 LEVEL-SECOND SEMESTER				
Course Code	**Course Title**	**Units**	**Status**	**LH**	**PH**
EEE 321	Electrical Power System Principles	2	C	30	30
EEE 322	Digital Electronic Circuits	2	C	30	-
EEE 323	Electric Circuit Theory II	2	C	30	-
EEE 324	Analogue Electronic Circuits I	2	C	30	-
GET 321	Engineering Economics	3	C	45	-
GET 322	Technical Writing and Communication	3	C	45	-
GET 323	Engineering Mathematics IV	3	C	45	-
GET 324	Renewable Energy Systems and Technology	3	C	30	45
*GET 399	SIWES II	3	C	9 WEEKS	
	Total	**20**		**285**	**75**

*** All SIWES credited in the 2nd Semester of 400-Level**

400 LEVEL-FIRST SEMESTER					
Course Code	**Course Title**	**Units**	**Status**	**LH**	**PH**
EEE 411	Electromagnetic Fields and Waves II	2	C	30	-
EEE 412	Reliability and Maintainability of Electrical and Electronic Components	2	C	30	-
EEE 413	Electrical Machines II	2	C	30	-
EEE 414	Communication Principles	3	C	30	45
EEE 415	Digital Electronics Laboratory	1	C	-	45
EEE 416	Signals and Systems	2	C	30	-
EEE 417	Control Systems Engineering I	3	C	30	45
EEE 418	Measurement and Instrumentation	3	C	30	45
	Total	**18**		**210**	**180**
400 LEVEL-SECOND SEMESTER					
Course Code	**Course Title**	**Units**	**Status**	**LH**	**PH**
EEE 421	Industrial Visit and Technical Presentation	2	C	1 Day Visit	
GET 421	Engineering Project I	2	C	-	90
GET 422	Engineering Valuation and Costing	2	C	30	-
*GET 299	SIWES I	3	C	9 WEEKS	
*GET 399	SIWES II	4	C	12 WEEKS	
*GET 499	SIWES III	4	C	12 WEEKS	
	Total	**17**		**30**	**114**

* **All SIWES credited in the 2nd Semester of 400-Level**

500 LEVEL-FIRST SEMESTER (ELECTRICAL ENGINEERING OPTION)					
Course Code	**Course Title**	**Units**	**Status**	**LH**	**PH**
EEE 510	Electrical Services Design	2	C	30	-
EEE 512	Electric Power Systems Engineering	2	C	30	-
EEE 514	High Voltage Engineering	2	C	30	-
EEE 516	Electrical Machine Design	2	C	30	-
EEE 517	Control Systems Engineering II	2	C	30	-
EEE 518	Fundamentals of Electric Vehicles	2	E	30	-
EEE 519	Modeling and Computer Simulation	3	C	45	-
GET 511	Engineering Project Management	3	C	45	-
GET 512	Engineering Law	2	C	30	-
EEE 599	Final Year Project	6	C		270
	Total	**18**		270	270
500 LEVEL-FIRST SEMESTER (ELECTRONIC ENGINEERING OPTION)					
EEE 510	Electrical Services Design	2	C	30	-
EEE 511	Telecommunications Engineering	2	C	30	-
EEE 513	Optical and Satellite Communication	2	C	30	-
EEE 515	Industrial Electronic Design	2	C	30	-
EEE 517	Control Systems Engineering II	2	C	30	-
EEE 518	Fundamentals of Electric Vehicles	2	E	30	-
EEE 519	Modeling and Computer Simulation	3	C	45	-
GET 511	Engineering Project Management	3	C	45	-
GET 512	Engineering Law	2	C	30	-
*EEE 599	Final Year Project	6	C		270
	Total	**18**		270	270

***EEE 593 to be credited in the 2nd Semester of 500-Level**

500 LEVEL-SECOND SEMESTER (ELECTRICAL ENGINEERING OPTION)					
Course Code	**Course Title**	**Units**	**Status**	**LH**	**PH**
EEE 521	Electric Power System Analysis, Planning and Protection	2	C	30	-
EEE 522	Power Electronics	3	C	45	-
EEE 523	Power System Modeling and Optimization	2	C	30	-
EEE 525	Hybrid Electric Vehicles	2	E	30	-
EEE 526	Electric Motor Drives	2	C	30	-
EEE 527	Power Systems Communication and Control	2	E	30	-
TEL 528	Energy Economy	2	E	30	-
GET 521	Engineering Management	3	C	45	-
EEE 599	Final Year Project	6	C	-	270
	Total	**18**		**180**	**270**
500 LEVEL-SECOND SEMESTER (ELECTRONIC ENGINEERING OPTION)					
EEE 520	Sensor and Artificial Neural Networks	2	C	30	-
EEE 522	Power Electronics	3	C	45	-
EEE 524	Digital Signal Processing	2	C	30	-
EEE 525	Hybrid Electric Vehicles	2	E	30	-
EEE 528	Mobile and Wireless Systems	2	E	30	-
EEE 529	Solid State Electronics	2	C	30	-
ELE 521	Embedded Systems Design and Programming	2	E	30	-
GET 521	Engineering Management	3	C	45	-
EEE 599	Final Year Project	3	C	-	270
	Total	**18**		**180**	**270**

***EEE 599 to be credited in the 2nd Semester of 500-Level**

COURSE DESCRIPTION

100 LEVEL

GET 111: Engineer in Society (1 Unit C: LH 15)

Learning Outcomes

At the end of this course, the students should be able to:

1. Differentiate between science, engineering and technology, and relate them to innovation;
2. Distinguish between the different cadres of engineering – engineers, technologists, technicians and craftsmen and their respective roles and competencies;
3. Identify and distinguish between the relevant professional bodies in engineering;
4. Categorize the goals of global development or sustainable development goals (SDGs); and
5. Identify and evaluate safety and risk in engineering practice.

Course Content
History, evolution and philosophy of science. Engineering and technology. The engineering profession – engineering family (engineers, technologists, technicians and craftsmen), professional bodies and societies. Engineers' code of conduct and ethics, and engineering literacy. Sustainable development goals (SDGs), innovation, infrastructures and nation building - economy, politics, business. Safety and risk analysis in engineering practice. Engineering competency skills – curriculum overview, technical, soft and digital skills. Guest seminars and invited lectures from different engineering professional associations.

CHM 113: General Chemistry I (2 Units C: LH 30)
Learning Outcomes
At the end of this course, the students should be able to:

1. Define atom, molecules and chemical reactions;
2. Discuss the modern electronic theory of atoms;
3. Write electronic configurations of elements on the periodic table;
4. Rationalize the trends of atomic radii, ionization energies, electronegativity of the elements, based on their position in the periodic table;
5. Identify and balance oxidation–reduction equation and solve redox titration problems;
6. Draw shapes of simple molecules and hybridised orbitals;
7. Identify the characteristics of acids, bases and salts and solve problems based on their quantitative relationship;
8. Apply the principles of equilibrium to aqueous systems using LeChatelier's principle to predict the effect of concentration, pressure and temperature changes on equilibrium mixtures;
9. Analyse and perform calculations with the thermodynamic functions, enthalpy, entropy and free energy; and
10. Determine rates of reactions and its dependence on concentration, time and temperature.

Course Content
Atoms, molecules, elements and compounds, and chemical reactions. Modern electronic theory of atoms. Electronic configuration, periodicity and building up of the periodic table. Hybridisation and shapes of simple molecules. Valence forces; Structure of solids. Chemical equations and stoichiometry; chemical bonding and intermolecular forces, kinetic theory of matter. Elementary thermochemistry; rates of reaction, equilibrium and thermodynamics. Acids, bases and salts. Properties of gases. Redox reactions and introduction to electrochemistry. Radioactivity.

CHM 114: General Practical Chemistry I (1 Unit C: PH 45)
Learning Outcomes
At the end of this course, the students should be able to:

1. State the general laboratory rules and safety procedures;
2. Collect scientific data and correct carry out chemical experiments;
3. Identify the basic glassware and equipment in the laboratory;
4. State the differences between primary and secondary standards;
5. Perform redox titration;
6. Record observations and measurements in the laboratory notebooks; and
7. Analyse the data to arrive at scientific conclusions.

Course Content
Laboratory experiments designed to reflect topics presented in courses CHM 113 and CHM 121. These include acid-base titrations, qualitative analysis, redox reactions, gravimetric analysis, data analysis and presentation.

MTH 112: Elementary Mathematics I (Algebra and Trigonometry) (2 Units C: LH 30)
Learning Outcomes
At the end of the course students should be able to:

1. 1. Define and explain set, subset, union, intersection, complements and demonstrate the use of Venn Diagrams;
2. Solve quadratic equations;
3. Solve trigonometric functions;
4. Identify various types of numbers; and
5. Solve some problems using binomial theorem.

Course Content
Elementary set theory, subsets, union, intersection, complements, Venn diagrams. Real numbers, integers, rational and irrational numbers. Mathematical induction, real sequences and series, theory of quadratic equations, binomial theorem, complex numbers, algebra of complex numbers, the argand diagram. De-Moiré's theorem, nth roots of unity. Circular measure, trigonometric functions of angles of any magnitude, addition and factor formulae.

PHY 111: General Physics I (Mechanics) (2 Units C: LH 30)
Learning Outcomes
On completion, the students should be able to:

1. Identify and deduce the physical quantities and their units;
2. Differentiate between vectors and scalars;
3. Describe and evaluate motion of systems on the basis of the fundamental laws of mechanics;
4. Apply Newton's laws to describe and solve simple problems of motion;
5. Evaluate work, energy, velocity, momentum, acceleration, and torque of moving or rotating objects;
6. Explain and apply the principles of conservation of energy, linear and angular momentum;
7. Describe the laws governing motion under gravity; and
8. Explain motion under gravity and quantitatively determine behaviour of objects moving under gravity.

Course Content
Space and time; units and dimension, vectors and scalars, differentiation of vectors: displacement, velocity and acceleration; kinematics; Newton's laws of motion (inertial frames, impulse, force and action at a distance, momentum conservation); relative motion; application of Newtonian mechanics; equations of motion; conservation principles in physics, conservative forces, conservation of linear momentum, kinetic energy and work, potential energy, system of particles, centre of mass; rotational motion; torque, vector product, moment, rotation of coordinate axes and angular momentum. Polar coordinates; conservation of angular momentum; circular motion; moments of inertia, gyroscopes and precession; gravitation: Newton's law of gravitation, Kepler's laws of planetary motion, gravitational potential energy, escape velocity, satellites motion and orbits.

PHY 113: General Physics III (Behaviour of Matter) (2 Units C: LH 30)

Learning Outcomes

On completion, the students should be able to:

1. Explain the concepts of heat and temperature and relate the temperature scales;
2. Define, derive and apply the fundamental thermodynamic relations to thermal systems;
3. Describe and explain the first and second laws of thermodynamics, and the concept of entropy;
4. State the assumptions of the kinetic theory and apply techniques of describing macroscopic behaviour;
5. Deduce the formalism of thermodynamics and apply it to simple systems in thermal equilibrium; and
6. Describe and determine the effect of forces and deformation of materials and surfaces.

Course Content

Heat and temperature, temperature scales; gas laws; general gas equation; thermal conductivity; first Law of thermodynamics; heat, work and internal energy, reversibility; thermodynamic processes; adiabatic, isothermal, isobaric; second law of thermodynamics; heat engines and entropy, Zero's law of thermodynamics; kinetic theory of gases; molecular collisions and mean free path; elasticity; Hooke's law, Young's shear and bulk moduli; hydrostatics; pressure, buoyancy, Archimedes' principles; Bernoullis equation and incompressible fluid flow; surface tension; adhesion, cohesion, viscosity, capillarity, drops and bubbles.

PHY 117: General Practical Physics I (1 Unit C: PH 45)

Learning Outcomes

On completion, the student should be able to:

1. Conduct measurements of some physical quantities;
2. Make observations of events, collect and tabulate data;
3. Identify and evaluate some common experimental errors;
4. Plot and analyse graphs; and draw conclusions from numerical and graphical analysis of data

Course Content

This introductory course emphasizes quantitative measurements. Experimental techniques. The treatment of measurement errors. Graphical analysis. The experiments include studies of meters, the oscilloscope, mechanical systems, electrical and mechanical resonant systems, light, heat, viscosity, etc. (covered in PHY111and 113). However, emphasis should be placed on the basic physical techniques for observation, measurements, data collection, analysis, and deduction.

STA 112: Probability I (3 Units C: LH 45)

Learning Outcomes

At the end of the course students should be able to

1. Explain the differences between permutation and combination;
2. Explain the concept of random variables and relate it to probability and distribution functions;
3. Describe the basic distribution functions; and
4. Explain the concept of exploratory data analysis.

Course Content
Permutation and combination. Concepts and principles of probability. Random variables. Probability and distribution functions. Basic distributions: Binomial, geometric, Poisson, normal and sampling distributions; exploratory data analysis.

GST 111: Communication in English (2 Units C: LH 15; PH 45)
Learning Outcomes
At the end of this course, students should be able to:
1. Identify possible sound patterns in English Language;
2. List notable language skills;
3. Classify word formation processes;
4. Construct simple and fairly complex sentences in English;
5. Apply logical and critical reasoning skills for meaningful presentations;
6. Demonstrate an appreciable level of the art of public speaking and listening; and
7. Write simple and technical reports.

Course Content
Sounds and sound patterns in English Language (vowels and consonants, phonetics and phonology). English word classes (lexical and grammatical words, definitions, forms, functions, usages, collocations). Major word formation processes; the sentence in English (types: structural and functional). Grammar and usage (tense, concord and modality). Reading and types of reading, comprehension skills, 3RsQ. Logical and critical thinking; reasoning methods (logic and syllogism, inductive and deductive argument, analogy, generalization and explanations). Ethical considerations, copyright rules and infringements. Writing activities: pre-writing (brainstorming and outlining). Writing (paragraphing, punctuation and expression). Post-writing (editing and proofreading). Types of writing (summary, essays, letter, curriculum vitae, report writing, note-making) etc. Mechanics of writing. Information and Communication Technology in modern language learning. Language skills for effective communication. The art of public speaking.

GST 112: Nigerian Peoples and Cultures (2 Units C: LH 30)
Learning Outcomes
At the completion of the course, the students are expected to be able:
1. Analyse the historical foundation of Nigerian cultures and arts in pre-colonial times;
2. Identify and list the major linguistic groups in Nigeria;
3. Explain the gradual evolution of Nigeria as a political entity;
4. Analyse the concepts of trade and economic self-reliance of Nigerian peoples in relation to national development;
5. Enumerate the challenges of the Nigerian state regarding nation building;
6. Analyse the role of the Judiciary in upholding fundamental human rights
7. Identify the acceptable norms and values of the major ethnic groups in Nigeria; and
8. List possible solutions to identifiable Nigerian environmental, moral and value problems.

Course Content
Nigerian history, culture and art up to 1800 (Yoruba, Hausa and Igbo peoples and cultures; peoples and cultures of the minority ethnic groups). Nigeria under colonial rule (advent of colonial rule in Nigeria; colonial administration of Nigeria). Evolution of Nigeria as a political unit (amalgamation of Nigeria in 1914; formation of political parties in Nigeria; nationalist movement and struggle for independence). Nigeria and challenges of nation building (military

intervention in Nigerian politics; Nigerian Civil War). Concepts of trade and economics of self-reliance (indigenous trade and market system; indigenous apprenticeship system among Nigerian peoples; trade, skill acquisition and self-reliance). Social justice and national development (definition and classification of law); Judiciary and fundamental rights. Individuals, norms and values (basic Nigerian norms and values, patterns of citizenship acquisition; citizenship and civic responsibilities; indigenous languages, usage and development; negative attitudes and conducts [Cultism, kidnapping and other related social vices]). Re-orientation, moral and national values (The 3Rs – Reconstruction, Rehabilitation and Re-orientation; re-orientation strategies: Operation Feed the Nation (OFN), Green Revolution, Austerity Measures, War Against Indiscipline and Corruption (WAIC), Mass Mobilization for Self-Reliance, Social Justice and Economic Recovery (MAMSER), National Orientation Agency (NOA). Current socio-political and cultural developments in Nigeria.

LIB 116: Use of Library **(1 Unit C: LH 15)**

Learning Outcomes

Upon successful completion of the course, students should be able to:

1. Explain the historical development and role of libraries in education and research;
2. Differentiate between types of libraries and the resources they offer;
3. Demonstrate effective library study techniques and research skills;
4. Utilize both physical and electronic library resources effectively;
5. Apply basic cataloguing and classification principles for locating materials;
6. Conduct academic research using digital tools and databases;
7. Properly cite sources using standard bibliographic referencing styles;
8. Identify and avoid plagiarism in academic writing;
9. Understand and apply copyright regulations in research and academic work; and
10. Perform structured web-based and internet research for academic purposes.

Course Content

Introduction and Historical Background of Libraries: Evolution and significance of libraries, The role of libraries in education and research, The Michael Okpara University of Agriculture, Umudike Library system. Types of Libraries and Their Resources: Academic, public, special, and national libraries, Print and non-print materials, Digital and electronic resources. Library and Education: The relationship between libraries and academic success, Role of the library in self-directed learning, Enhancing research and innovation through libraries. Library Study Skills: Note-taking and summarization techniques, Effective reading and comprehension strategies, Time management for academic success. Library Resources and Organization: Structure of an academic library, Arrangement and classification of resources, The role of librarians in information management. Using Library Resources: Print and Electronic: Accessing books, journals and reference materials, Digital libraries and online repositories, Utilizing institutional e-learning resources. Library Search, Cataloguing and Classification Schemes: The Dewey decimal classification (DDC), The Library of Congress Classification (LCC), OPAC (Online Public Access Catalogue) and other search tools. Databases and Digital Research Tools: Introduction to academic databases (e.g., Google Scholar, JSTOR, ResearchGate, etc.), Open access journals and institutional repositories. Evaluating sources for credibility and reliability. Research Writing and Academic Techniques: Structuring academic papers and reports, Formulating research questions, Literature review techniques. Bibliographic Citation and Referencing Methods: APA, MLA, Chicago, and Harvard citation styles, Managing citations with software tools (e.g., Mendeley, Zotero, EndNote), The importance of proper referencing in academic

writing. Plagiarism and Academic Integrity: Understanding plagiarism and its consequences, Techniques for paraphrasing and summarizing, Ethical considerations in research. Copyright Laws and Intellectual Property Rights: Understanding copyright regulations, Fair use policies and restrictions, Copyright implications in academic research. Conducting Internet and Web-Based Research: Effective internet search strategies, evaluating online sources for accuracy and reliability. The role of artificial intelligence and search engines in research.

IGB 111: Basic Igbo Literacy (1 Unit C: LH 15)

Learning Outcomes

Upon successful completion of the course, students should be able to:

1. Recognize and correctly pronounce Igbo language alphabets;
2. Read and pronounce Igbo language texts correctly;
3. Construct and interpret sentences; and
4. Understand the structured learning path from elementary to advanced levels of Igbo language studies

Course Content

Igbo alphabets, Parts of speech: Nouns and pronouns, Parts of speech: Preposition and conjunctions, Parts of speech: Adjectives, Adverbs and verbs, Interrogatives, numerals and exclamation, Phrases and tones, Clauses, Affixation, Punctuation marks, Sentence types, Morphemes, Igbo literature: Teaching of Igbo culture, Igbo songs and poetry.

FRE 114: Elementary French I (1 Unit E: LH 15)

Learning Outcomes

By the end of the course, students should be able to:

1. Recognize and correctly pronounce French alphabets and phonetics;
2. Communicate basic information in French, including greetings and self-introductions;
3. Read and pronounce French texts correctly; and
4. Construct and interpret elementary sentences.

Course Content

French Culture and Civilization: Importance of French language in Nigeria, Overview of Francophone countries and their relationship with Nigeria. Knowledge of France: Introduction to France's history and major major cities, Contribution of France to Development of Science, Technology and Agriculture; Medicine and biology; Physics, chemistry and engineering; Agriculture, clothing and Food processing; Mathematics; Arts, communication and Computers; Philosophy. AGRICULTURE (L'AGRICULTURE): Position of France in agricultural produce, Definition of some related agricutral terms, Quelques verbes utilisent dans L'agriculture (Some verbs used in agriculture), Les outils et machines agricols (Some agricultural tools and machines), Some Educational terms in English and French, Some French verbs associated with education, Informatique et la technologie d'information, Verbs associated with ICT. ENGINEERING (GENIE): Genie Chimique (Chemical Engineering), Genie Electrique (Electrical Enginnering), Mechanical Engineering (Genie Mecanique), Génie Civile (Civil Engineering), Les sciences naturelles, Physiques et Appliques (Natural, Physical and Applied Sciences), La Santé et La Médicine (Health and medicine), L'Economie (Economics), Le Tourisme (Tourism). INTRODUCTION A LA PHONETIQUE (INTRODUCTION TO PHONETICS: The French Alphabet and accents, Spellings and pronunciation, Classroom pronunciation practice. LES SALUTATIONS ET FORMULES DE POLITESSE (GREETINGS AND POLITE REMARKS: Common greetings and self-introduction, Asking

about Someone's wellbeing, Introduction of Self and others, (Metiers/Professions) Occupation/professsions, Introducing someone (Presenter quelqu'un), Nationality, Address, place and Date of birth, Countries and their nationals, (residential Address) Domicile, (Place of birth) lieu de naissance, Les nombres: cardinaux et ordinaux (Numbers : cardinal and ordinal), (Telling time, Day, Month, Year, and date) Dire L'heure, Les jours, Les mois et les années). LES OBJETS UTILISESS DANS LA CLASSE, ARTICLES, GENRES, PREPOSITIONS (OBJECTS USED IN THE CLASSROOM, ARTICLES, GENDER AND PREPOSTIONS.

GER 115: Elementary German I (1 Unit E: LH 15)

Learning Outcomes

Upon successful completion of this course, students will:

1. Recognize and correctly pronounce German phonetics and alphabets;
2. Develop a basic understanding of German grammar and vocabulary; and
3. Utilize fundamental grammar structures in writing and conversation.

Course Content

Introduction to German Language, Pronunciation of German alphabets and special characters (ä, ö, ü, ß), Personal pronouns and auxiliary verbs (sein, haben, werden). Greetings and Personal Information, Common greetings and self-introduction, Asking and answering personal details (name, age, nationality, profession). Numbers, Dates and Time, Counting from 0 to 1 billion, Ordinal numbers and telling time, Days, months, seasons and their significance in agriculture. Articles, Nouns, and Cases, Definite and indefinite articles, Singular and plural forms, Basic introduction to nominative, accusative, dative and genitive cases.

EEE 121: Introduction to Electrical and Electronics Engineering (2 Units C: LH 30)

Learning Outcomes

At the end of this course, the students should be able to:

1. Comprehend the duties and functions of an Electrical and Electronics Engineer (EEE);
2. State the requirements for the profession and career opportunities;
3. State the careers related to EEE;
4. Describe passive electrical components; and
5. Explain the future of EEE.

Course Content

History of Electrical Engineering. Evolution of EEE. Duties of EE Engineers. Areas of specialisation and work environment. Skill requirements (soft and hard). Qualities for EE Engineers. Careers related to EEE. Typical course modules. Job outlook/opportunities for EE Engineers. Future of EEE. Professional registration (NSE, COREN, IEEE, IET, etc.). Passive components (R, L, C, transformers): descriptive features, including values and colour codes, uses in electrical circuits. DC and AC signal parameters.

GET 121: Design Thinking and Innovation (1 Unit C: LH 15)

Learning Outcomes

Upon completion of this course, graduates will be able to:

1. Interpret established Design Thinking theories, concepts and processes, as well as analyze new directions in the field;
2. Apply user centered research methods that appropriately respond to an area of practice to generate a solution to a specific real-world problem;

3. Communicate an understanding of various problem-solving methods and their relationship to Design Thinking strategies;
4. Collaborate effectively in group-based work;
5. Break cognitive fixedness and approach problems with a new mindset that integrates creative problem-solving and management; and
6. Put design thinking into action by collaborating with peers from a wide range of professional experiences and backgrounds.

Course Content

Introduction to Design and Problem Solving in Engineering. Principles of Teamwork and Collaboration in Design. Breaking down complex Engineering problems. The Engineering Design Process: From Need to Concept. Problem Definition and Stakeholder Analysis. Brainstorming, Ideation and Concept Selection. Modeling and Prototyping Techniques (Sketching, CAD, Simulations). Team Presentations on Concept Development. Systems Thinking and Integration in Mechatronic Design. Design Thinking suite of methods and techniques applied to project lifecycles with an emphasis on interdisciplinary practice. Ethical and Social Impact of Engineering Solutions. Final Project Work and Peer Feedback. Final Team Presentations and Design Review.

GET 122: Engineering Graphics and Solid Modelling I (2 Units C: LH 15; PH 45)

Learning Outcomes

At the end of this course, the students should be able to:

1. Have a good grasp of design thinking and be obsessed with the determination to apply such to solving simple every day and also complex problems;
2. Recognize the fundamental concepts of engineering drawing and graphics;
3. Show skills to represent the world of engineering objects in actionable solid models, and put such models in a form where they can be inputs for simulation and analyses;
4. Analyse such models for strength and cost;
5. Prepare the objects for modern production and manufacturing techniques of additive and subtractive manufacturing;
6. Recognise that engineering is multidisciplinary in the sense that mechanical, electrical and other parts of physical structures are modelled in context as opposed to the analytical nature of the courses they take; and
7. Analyse and master the basics of mechanical and thermal loads in engineering systems.

Course Content

Introduction to design thinking and engineering graphics. First and third angle orthogonal projections. Isometric projections; sectioning, conventional practices, conic sections and development. Freehand and guided sketching – pictorial and orthographic. Visualisation and solid modelling in design, prototyping and product-making. User interfaces in concrete terms. Design, drawing, animation, rendering and simulation work spaces. Sketching of 3D objects. Viewports and sectioning to shop drawings in orthographic projections and perspectives. Automated viewports. Sheet metal and surface modelling. Material selection and rendering. This course will use latest professional design tools such as fusion 360, solid works, solid edge or equivalent.

GET 123: Engineering Laboratory I (1 Unit C: PH 45)

Learning Outcomes

Upon successful completion of the course, students will be able to:
1. Understand and apply the scientific method and engineering experimental procedures;
2. Perform measurements and data acquisition using basic laboratory instruments;
3. Analyze and interpret experimental data using appropriate mathematical and statistical tools;
4. Write clear, structured technical lab reports and communicate findings effectively;
5. Demonstrate proper lab safety, teamwork, and professional conduct; and
6. Understand the physical principles underlying simple mechatronics systems.

Course Content

Introduction to Laboratory Practices, Safety Procedures and Report Writing. Measurement Techniques and Error Analysis (Length, Mass, Volume, Time, Temperature). Use of Vernier Calipers, Micrometers, and Multimeters. Force, Equilibrium and Vector Analysis. Newton's Laws and Friction. Oscillations and Simple Harmonic Motion. Ohm's Law and Series/Parallel Circuits. Kirchhoff's Laws and Network Theorems. Basic Data Acquisition: Introduction to Sensors and Arduino. Arduino IDE installation and basics. Hydrostatic Pressure and Bernoulli's Principle. Stress-Strain Relationship. Thermal Conductivity and Heat Loss. Basic Signal Measurement: Oscilloscope and Signal Generator Use. Overview of robotics components. DC motor and servo motor control using motor drivers (e.g., L298N). Final Report Submission and Review.

CHM 121: General Chemistry II (2 Units C: LH 30)

Learning Outcomes

At the end of this course, the students should be able to:
1. State the importance and development of organic chemistry;
2. Define fullerenes and its applications;
3. Discuss electronic theory;
4. Determine the qualitative and quantitative of structures in organic chemistry;
5. State rules guiding nomenclature and functional group classes of organic chemistry;
6. Determine the rate of reaction to predict mechanisms of reaction;
7. Identify classes of organic functional group with brief description of their chemistry;
8. Discuss comparative chemistry of group 1A, IIA and IVA elements; and
9. Describe basic properties of transition metals.

Course Content

Historical survey of the development and importance of organic chemistry; fullerenes as fourth allotrope of carbon, uses as nanotubules, nanostructures, nanochemistry. Electronic theory in organic chemistry. Isolation and purification of organic compounds; determination of structures of organic compounds including qualitative and quantitative analysis in organic chemistry; nomenclature and functional group classes of organic compounds. Introductory reaction mechanism and kinetics. Stereochemistry. The chemistry of alkanes, alkenes, alkynes, alcohols, ethers, amines, alkyl halides, nitriles, aldehydes, ketones, carboxylic acids and derivatives. The chemistry of selected metals and non-metals. Comparative chemistry of group IA, IIA and IVA elements. Introduction to transition metal chemistry.

CHM 124: General Practical Chemistry II (1 Unit C: PH 45)

Learning Outcomes

At the end of this course, the students should be able to:
1. State the general laboratory rules and safety procedures;
2. Collect scientific data and correctly carry out chemical experiments;

3. Identify the basic glassware and equipment in the laboratory;
4. Identify and carry out preliminary tests which include ignition, boiling point, melting point, test on known and unknown organic compounds;
5. Carry out solubility tests on known and unknown organic compounds;
6. Carry out elemental tests on known and unknown compounds; and
7. Carry out functional group/confirmatory test on known and unknown compounds which could be acidic/basic/neutral organic compounds.

Course Content
Continuation of CHM 114. Additional laboratory experiments to include functional group analysis, quantitative analysis using volumetric methods.

MTH 122: Elementary Mathematics II (Calculus) (2 Units C: LH 30)
Learning Outcomes
At the end of the course, students should be able to:
1. Identify the types of rules in differentiation and integration;
2. Recognise and understand the meaning of function of a real variable, graphs, limits and continuity;
3. Solve some applications of definite integrals in areas and volumes;
4. Solve function of a real variable, plot relevant graphs, identify limits and idea of continuity;
5. Identify the derivative as limit of rate of change;
6. Identify techniques of differentiation and perform extreme curve sketching;
7. Identify integration as an inverse of differentiation;
8. Identify methods of integration and definite integrals; and
9. Perform integration application to areas, volumes.

Course Content
Functions of a real variable, graphs, limits and idea of continuity. The derivative, as limit of rate of change. Techniques of differentiation, maxima and minima. Extreme curve sketching, integration, definite integrals, reduction formulae, application to areas, volumes (including approximate integration: Trapezium and Simpson's rule).

MTH 123: Elementary Mathematics III (Vectors, Geometry and Dynamics) (2 Units C: LH 30)
Learning Outcomes
At the end of the course, students should be able to:
1. Solve some vectors in addition and multiplication;
2. Calculate force and momentum; and
3. Solve differentiation and integration of vectors.

Course Content
Geometric representation of vectors in 1-3 dimensions, components, direction cosines. Addition, scalar, multiplication of vectors, linear independence. Scalar and vector products of two vectors. Differentiation and integration of vectors with respect to a scalar variable. Two-dimensional co-ordinate geometry. Straight lines, circles, parabola, ellipse, hyperbola. Tangents, 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 and resisted vertical motion. Elastic string and simple pendulum. Impulse, impact of two smooth spheres and a sphere on a smooth surface.

PHY 122: General Physics II (Electricity and Magnetism) (2 Units C: LH 30)

Learning Outcomes

At the end of the course, students should be able to:

1. Describe the electric field and potential, and related concepts, for stationary charges;
2. Calculate electrostatic properties of simple charge distributions using Coulomb's law, Gauss's law, and electric potential;
3. Describe and determine the magnetic field for steady and moving charges;
4. Determine the magnetic properties of simple current distributions using Biot-Savart and Ampere's law;
5. Describe electromagnetic induction and related concepts and make calculations using Faraday and Lenz's laws;
6. Explain the basic physical significance of Maxwell's equations in integral form;
7. Evaluate DC circuits to determine the electrical parameters; and
8. Determine the characteristics of AC voltages and currents in resistors, capacitors, and Inductors.

Course Content

Forces in nature. Electrostatics (electric charge and its properties, methods of charging). Coulomb's law and superposition. Electric field and potential. Gauss's law. Capacitance. Electric
dipoles. Energy in electric fields. Conductors and insulators. DC circuits (current, voltage and resistance). Ohm's law. Resistor combinations. Analysis of DC circuits. Magnetic fields. Lorentz
force. Biot-Savart and Ampère's laws. Magnetic dipoles. Dielectrics. Energy in magnetic fields. Electromotive force. Electromagnetic induction. Self and mutual inductances. Faraday and Lenz's laws. Step up and step-down transformers. Maxwell's equations. Electromagnetic oscillations and waves. AC voltages and currents applied to inductors, capacitors, and resistance.

PHY 124: General Physics IV (Vibration Waves and Optics) (2 Units C: LH 30)

Outcomes

At the end of the course, students should be able to:

1. Describe and quantitatively analyse the behaviour of vibrating systems and wave energy;
2. Explain the propagation and properties of waves in sound and light;
3. Identify and apply the wave equations; and explain geometrical optics and principles of optical instruments

Course Content

Simple harmonic motion (SHM). Energy in a vibrating system. Damped SHM. Resonance and transients. Coupled SHM. Q values and power response curves. Normal modes. Waves (types and properties of waves as applied to sound). Transverse and longitudinal waves (superposition, interference, diffraction, dispersion, polarization). Waves at interfaces (energy and power of waves). The wave equation. 2-D and 3-D wave equations. Wave energy and power. Phase and group velocities. Echo and beats. The Doppler-effect. Propagation of sound in gases, solids and liquids and their properties. Optics: Nature and propagation of light. Reflection and refraction. Internal reflection. Scattering of light. Reflection and refraction at plane and spherical surfaces. Thin lenses and optical instruments. Wave nature of light. Dispersion. Huygens's principle (interference and diffraction).

PHY 127: **General Practical Physics II** **(1 Unit C: PH 45)**

Learning Outcomes

On completion, the student should be able to:

1. Conduct measurements of some physical quantities;
2. Make observations of events, collect and tabulate data;
3. Identify and evaluate some common experimental errors;
4. Plot and analyse graphs;
5. Draw conclusions from numerical and graphical analysis of data; and
6. Prepare and present practical reports.

Course Content

This practical course is a continuation of PHY 117 and is intended to be taught during the second semester of the 100 level to cover the practical aspect of the theoretical courses that have been covered with emphasis on quantitative measurements, the treatment of measurement errors, and graphical analysis. However, emphasis should be placed on the basic physical techniques for observation, measurements, data collection, analysis and deduction.

ENG 121: Use of English **(1 Unit C: LH 15)**

Learning Outcomes

By the end of this course, students should be able to:

1. Comprehend and utilize vocabulary relevant to diverse fields;
2. Identify and correctly apply various figures of speech in writing and speech;
3. Demonstrate competence in writing formal and informal letters, essays, reports, and articles;
4. Critically analyze and review literary texts; and
5. Understand and apply phonetic principles for clear and effective oral communication.

Course Content

Vocabulary Development: Exploring registers and levels of usage in different fields such as medicine, military, communication, marketing, Law, Literature, Agriculture and Sciences, Direct and indirect speech. Figures of speech: Understanding and application of smile, metaphor, personification, apostrophe, metonymy, synecdoche, hyperbole, climate, euphemism, irony, paradox and oxymoron. Writing Skills: Letter writing - formal, informal, semi- formal, Essay writing, Report writing, Article writing, letters to editors and speech writing techniques. Book Review: A literary book will be assigned at the beginning of the semester. Discussions and reviews to be guided by the instructor. Oral Communication: Introduction to Phonetics and Phonology. ii)Classification of speech sounds: vowels and consonants. Understanding syllables: mono- syllabic, di- syllabic and multi - syllabic words. Mastering stress and intonation patterns. This course is structured to provide students with essential English language skills necessary for academic success and professional communication in their respective disciplines.

IGB 121: Readings and Practice in Igbo **(1 Unit C: LH 15)**

Learning Outcomes

By the end of this course, students should be able to:

1. Understand fundamental aspects of Igbo language linguistics, literature and culture to enhance appreciation and competence;
2. Apply Igbo language and communication skills effectively to diverse fields; social, political and economic contexts; and

3. Develop strategies for independent Igbo language learning and resource utilization.

Course Content
Essay writing, Figures of speech, Traditional literature, Written literature, Translations and Dictionaries in Igbo, Test, Igbo indigenous knowledge, Speech writing, Comprehension, poetry or drama, Research in Igbo within the university, using computer to write Igbo.

FRE 124: Elementary French II (1 Unit E: LH 15)
Learning Outcomes
By the end of the course, students should be able to:
1. Communicate in basic French for everyday interactions;
2. Identify cultural differences and similarities between French-speaking and non-French-speaking countries; and
3. Apply French in academic and professional contexts.

Course Content
LES VERBES ET LES ADVERBES FRANCAIS (FRENCH VERBS AND ADVERBS). CONSTRUCTION DES PHRASES FRANCAISES (FRENCH SENTENCE CONSTRUCTION). Introduction to essential verbs (être, avoir, aller, aimer). Present tense conjugation and sentence construction. Sentence Formation and Communication. EXPRIMER LES ACTIVITES QUOTIDIEN (DAILY ACTIVITY EXPRESSIONS. -Sentence Formation and Communication. Using adjectives, pronouns, and common expressions. Everyday vocabulary and basic sentence structures. Engaging in basic conversations and describing daily activities. LES ADJECTIFS POSSESSIFS (POSSESSIVE ADJECTIVES).

GER 125: Elementary German II (1 Unit E: LH 15)
Learning Outcomes
Upon successful completion of this course, students will:
1. Engage in simple dialogues related to daily life, education and work;
2. Identify cultural differences and similarities between Nigeria and German-speaking countries; and
3. Apply German language skills in understanding research materials and global marketing trends.

Course Content
Verbs – Modal, Separable and Inseparable. Modal verbs and their applications. Separable and inseparable verb prefixes. Family, Professions and Descriptive Adjectives. Vocabulary for family structures. Identifying professions and their gender forms. Adjective declension and sentence construction. The Human Body, Colors and Opposites. Naming body parts and their functions. Understanding and using colors in different contexts. Common antonyms and contrasting words.

GET 211: Applied Electricity I (3 Units C: LH 30; PH 45)
Learning Outcomes
Students will be able to:
1. Discuss the fundamental concepts of electricity and electrical d.c. circuits;
2. State, explain and apply the basic d.c. circuit theorems;
3. Explain the basic a.c. circuit theory; and
4. Apply to solution of simple circuits.

Course Content
Fundamental concepts: Electric fields, charges, magnetic fields. Current, B-H curves Kirchhoff's laws, superposition. Thevenin Norton theorems, Reciprocity, RL, RC, RLC circuits. DC, AC bridges, Resistance, Capacitance, Inductance measurement, Transducers, Single phase circuits, Complex j - notation, AC circuits, impedance, admittance and susceptance.

GET 212: Engineering Graphics and Solid Modeling II (2 Units C: LH 15; PH 45)
Learning Outcomes
Students should be able to:

1. Apply mastery of the use of projections to prepare detailed working drawing of objects and designs;
2. Develop skills in parametric design to aid their ability to see design in the optimal specification of materials and systems to meet needs;
3. Be able to analyze and optimize designs on the basis of strength and material minimization;
4. Get their appetites wet in seeing the need for the theoretical perspectives that create the basis for the analysis that are possible in design and optimization, and recognize/understand the practical link to excite their creativity and ability to innovate; and
5. Be able to translate their thoughts and excitements to produce shop drawings for multi-physical, multidisciplinary design.

Course Content
Projection of lines, auxiliary views and mixed projection. Preparation of detailed working production drawing; semi-detailed drawings, conventional presentation methods. Solid, surface and shell modeling. Faces, bodies and surface intersections. Component-based design. Component assembly and motion constraints. Constrained motions and animation. Introduction to electronics modeling. Electronics board layout preparation, Component libraries and Schematic design. Parametric modeling and adaptive design. Simulation for material optimization. Designing for manufacturing. Additive and subtractive manufacturing. Production for 3-D printing, Laser cutting and CNC machinery. Arrangement of engineering components to form a working plant (Assembly Drawing of a Plant).

GET 213: Engineering Mathematics I (3 Units C: LH 45)
Learning Outcomes
At the end of the course, the students should be able to:

1. Solve qualitative problems based on vector and matrix analyses such as linear independence and dependence of vectors, rank etc;
2. Describe the concepts of limit theory and nth order differential equations and their applications to physical phenomena;
3. Solve the problems of differentiation of functions of two variables and know about the maximization and minimization of functions of several variables;
4. Describe the applications of double and triple integration in finding the area and volume of engineering solids and explain the qualitative applications of Gauss, Stoke's and Green's theorem;
5. Explain ordinary differential equations and applications and develop a mathematical model of linear differential equations, as well as appreciate the necessary and sufficient conditions for total differential equations; and

6. Analyse basic engineering models through partial differential equations such as wave equation, heat conduction equation, etc., as well as Fourier series, initial conditions and its applications to different engineering processes.

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

GET 214: Applied Mechanics (3 Units C: LH 45)
Learning Outcomes
Students will acquire the ability to:
1. Explain the fundamental principles of applied mechanics; particularly, equilibrium analysis, friction, kinematics and momentum;
2. Identify, formulate and solve complex engineering problems by applying principles of engineering, science, mathematics and applied mechanics;
3. Synthesize Newtonian Physics with static analysis to determine the complete load impact (net forces, shears, torques and bending moments) on all components (members and joints) of a given structure with a load; and
4. Apply engineering design principles to produce solutions that meet specified needs with consideration of public health, safety and welfare, as well as global, cultural, social, environmental and economic factors.

Course Content
Forces, moments, couples. Equilibrium of simple structures and machine parts. Friction. First and second moments of area; centroids. Kinematics of particles and rigid bodies in plane motion. Newton's laws of motion. Kinetic energy and momentum analyses.

GET 215: Students Workshop Practice (2 Units C: LH 15; PH 45)
Learning Outcomes
At the end of this course, the students should be able to:
1. Identify various basic hands and machine tools, analogue and digital measurement devices and instruments and acquire skills in their effective use and maintenance;
2. Practically apply basic engineering technologies, including metrology, casting, metal forming and joining, materials removal, machine tooling (classification, cutting tool action, cutting forces, non-cutting production) and CNC machining technology;
3. Master workshop and industrial safety practices, accident prevention and ergonomics;
4. Physically recognise different electrical and electronic components like resistances, inductances, capacitances, diodes, transistors and their ratings;
5. Connect electric circuits, understand different wiring schemes and check ratings of common household electrical appliances and their basic maintenance; and
6. Determine household and industrial energy consumption and understand practical energy conservation measures.

Course Content
The course comprises general, mechanical and electrical components: supervised hands-on experience in safe usage of tools and machines for selected tasks; Use of measuring instruments (calipers, micrometers, gauges, sine bar, wood planners, saws, sanders, and pattern making). Machine shop: lathe work shaping, milling, grinding, reaming, metal spinning. Hand tools, gas and arc welding, cutting, brazing and soldering. Foundry practice. Industrial safety and

accident prevention, ergonomics, metrology. Casting processes. Metal forming processes: hot-working and cold-working processes (forging, press-tool work, spinning, etc.). Metal joining processes (welding, brazing and soldering). Heat treatment. Material removal processes. Machine tools and classification. Simple theory of metal cutting. Tool action and cutting forces. Introduction to CNC machines. Supervised identification, use and care of various electrical and electronic components such as resistors, inductors, capacitors, diodes and transistors. Exposure to different electric circuits, wiring schemes, analogue and digital electrical and electronic measurements. Household and industrial energy consumption measurements. Practical energy conservation principles.

GET 216: Fundamentals of Thermodynamics (3 Units C: LH 45)

Learning Outcomes

At the end of this course, the students should be able to:

1. Describe basic concepts of thermodynamics, quantitative relations of Zeroth, first, second and third laws;
2. Define and explain system (surrounding, closed and open system), control volume and control mass, extensive and intensive properties;
3. Calculate absolute and gage pressure and absolute temperature, calculate changes in kinetic, potential, enthalpy and internal energy;
4. Evaluate the properties of pure substances i.e. evaluate the state of the pure substances such as compressed liquid, saturated liquid-vapour mixture and superheated vapour using property diagrams and tables; arrange the ideal and real gas equations of state,
5. Formulate the first law of thermodynamics for a closed system i.e. organize the change in energy in the closed systems via heat and work transfer;
6. Distinguish heat transfer by conduction, convection and radiation, and calculate the amount of heat energy transferred;
7. Calculate the changes in moving boundary work, spring work, electrical work and shaft work in closed systems;
8. Apply the first law of thermodynamics for closed systems and construct conservation of mass and energy equations;
9. Formulate the first law of thermodynamics to the open systems i.e. describe steady-flow open system, apply the first law of thermodynamics to the nozzles, diffusers, turbines, compressors, throttling valves, mixing chambers, heat exchangers, pipe and duct flow;
10. Construct energy and mass balance for unsteady-flow processes;
11. Evaluate thermodynamic applications using second law of thermodynamics;
12. Calculate thermal efficiency and coefficient of performance for heat engine, refrigerators and heat pumps; and
13. Restate perpetual-motion machines, reversible and irreversible processes.

Course Content

Basic concepts, definitions and laws (quantitative relations of Zeroth, first, second and third laws of thermodynamics). Properties of pure substances: the two-property rule (P-V-T behaviour of pure substances and perfect gases); state diagrams. The principle of corresponding state; compressibility relations; reduced pressure; reduced volume; temperature; pseudo-critical constants. The ideal gas: specific heat, polytropic processes. Ideal gas cycles; Carnot; thermodynamic cycles, turbines, steam and gas, refrigeration. The first law of thermodynamics – heat and work, applications to open and closed systems. The steady flow energy equation (Bernoulli's equation) and application. Second law of thermodynamics, heat cycles and efficiencies.

ENT 211: Entrepreneurship and Innovation (2 Units C: LH 30)

Learning Outcomes

At the end of this course, students should be able to:

1. Explain the concepts and theories of entrepreneurship, entrepreneurship, opportunity seeking, new value creation and risk-taking;
2. State the characteristics of an entrepreneur;
3. Analyze the importance of micro and small businesses in wealth creation, employment generation and financial independence;
4. Engage in entrepreneurial thinking;
5. Identify key elements in innovation;
6. Describe the stages in enterprise formation, partnership and networking, including business planning;
7. Describe contemporary entrepreneurial issues in Nigeria, Africa and the rest of the world; and
8. State the basic principles of e-commerce.

Course Content

The concept of entrepreneurship (entrepreneurship, intrapreneurship/corporate entrepreneurship); theories, rationale and relevance of entrepreneurship (Schumpeterian and other perspectives, risk-taking, necessity and opportunity-based entrepreneurship, and creative destruction); characteristics of entrepreneurs (opportunity seeker, risk-taker, natural and nurtured, problem solver and change agent, innovator and creative thinker); entrepreneurial thinking (critical thinking, reflective thinking and creative thinking). Innovation (The concept of innovation, dimensions of innovation, change and innovation, knowledge and innovation). Enterprise formation, partnership and networking (basics of business plan, forms of business ownership, business registration and alliance formation, and joint ventures). Contemporary entrepreneurship issues (knowledge, skills and technology, intellectual property, virtual office and networking). Entrepreneurship in Nigeria (biography of inspirational entrepreneurs, youth and women entrepreneurship, entrepreneurship support institutions, youth enterprise networks and environmental and cultural barriers to entrepreneurship). Basic principles of e-commerce.

GST 217: Philosophy, Logic and Human Existence (2 Units C: LH 30)

Learning Outcomes

At the end of the course, students should be able to:

1. Know the basic features of philosophy as an academic discipline;
2. Identify the main branches of philosophy and the centrality of logic in philosophical discourse;
3. Know the elementary rules of reasoning;
4. Distinguish between valid and invalid arguments;
5. Think critically and assess arguments in texts, conversations and day-to-day discussions;
6. Critically asses the rationality or otherwise of human conduct under different existential conditions;
7. Develop the capacity to extrapolate and deploy expertise in logic to other areas of knowledge; and
8. Guide his or her actions, using the knowledge and expertise acquired in philosophy and logic.

Course Content
Scope of philosophy; notions, meanings, branches and problems of philosophy. Logic as an indispensable tool of philosophy. Elements of syllogism, symbolic logic – the first nine rules of inference. Informal fallacies, laws of thought, nature of arguments. Valid and invalid arguments, logic of form and logic of content – deduction, induction and inferences. Creative and critical thinking. Impact of philosophy on human existence. Philosophy and politics, philosophy and human conduct, philosophy and religion, philosophy and human values, philosophy and character molding, etc.

EEE 221: Applied Electricity II (3 Units C: LH 30; PH 45)
Learning Outcomes
Students will be able to:
1. Differentiate between various d.c. and a.c. machines;
2. Explain the principles of operation of machines;
3. Explain the operation of basic semiconductor devices and their basic applications; and
4. Explain the principle of operation of communication systems with examples.

Course Content
Basic machines – DC, synchronous alternators, transformers, equivalent circuits. Three- phase balanced circuits, PN junction diode, BJTs, FETs, thyristors, communications fundamentals, introduction of TV, Radio, Telephone systems.

EEE 222: Electrical Engineering Materials (3 Units C: LH 45)
Learning Outcomes
Students will be able to:
1. Discuss electron conduction mechanisms in semiconductors;
2. Explain transport phenomena in semiconductors; and
3. Describe semiconductors device fabrication techniques.

Course Content
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 metals and electron emissions; carriers and transport phenomena in semiconductors, characteristics of some electron and resistors, diodes, transistors, photo cell and light emitting diode. Elementary discrete devices fabrication techniques and IC technology.

GET 221: Computing and Software Engineering (3 Units C: LH 30; PH 45)
Learning Outcomes
At the end of the course, the students should be able to:

1. Describe and apply computing, software engineering knowledge, best practices and standards appropriate for complex engineering software systems;
2. Develop competence in designing, evaluating and adapting software processes and software development tools to meet the needs of an advanced development project through practical object-oriented programming exposure taught in concrete terms with a specific modern language – preferable selected from Python, Java or C++;
3. Use widely available libraries to prepare them for machine learning, graphics and design simulations;
4. Develop skills in eliciting user needs and designing an effective software solution;
5. Recognise human, security, social and entrepreneurial issues and responsibilities relevant to engineering software and the digitalization of services; and

6. Acquire capabilities that can further be developed to make them productively employable by means of short Internet courses in specific areas.

Course Content

Introduction to computers and computing; computer organization – data processing, memory, registers and addressing schemes; Boolean algebra; floating-point arithmetic; representation of non-numeric information; problem-solving and algorithm development; coding (solution design using flowcharts and pseudo codes). Data models and data structures; computer software and operating system; computer operators and operators' precedence; components of computer programs; introduction to object oriented, structured and visual programming; use of MATLAB in engineering applications. ICT fundamentals, Internet of Things (IoT). Elements of software engineering.

GET 223: Engineering Mathematics II (3 Units C: LH 45)

Learning Outcomes

At the end of the course, the students should be able to:

1. Describe physical systems using ordinary differential equations (ODEs);
2. Explain the practical importance of solving ODEs, solution methods, and analytically solve a wide range of ODEs, including linear constant coefficient types; Numerically solve differential equations using MATLAB and other emerging applications;
3. Perform calculus operations on vector-valued functions, including derivatives, integrals,
   curvature, displacement, velocity, acceleration and torsion, as well as on functions of several variables, including directional derivatives and multiple integrals;
4. Solve problems using the fundamental theorem of line integrals, Green's theorem, the divergence theorem and Stokes' theorem and perform operations with complex numbers;
5. Apply the concept and consequences of analyticity and the Cauchy-Riemann equations and of results on harmonic and entire functions of complex variables, as well as the theory of conformal mapping to solve problems from various fields of engineering; and
6. Evaluate complex contour integrals directly and by the fundamental theorem, apply the Cauchy integral theorem in its various versions and the Cauchy integral formula.

Course Content

Introduction to ordinary differential equations (ODEs); theory, applications, methods of solution; second order differential equations. Advanced topics in calculus (vectors and vector-valued function, line integral, multiple integral and their applications). Elementary complex analysis including functions of complex variables, limits and continuity. Derivatives, differentiation rules and differentiation of integrals. Cauchy-Riemann equation, harmonic functions, basic theory of conformal mapping, transformation and mapping and its applications to engineering problems. Special functions.

GET 224: Strength of Materials (3 Units C: LH 45)

Learning Outcomes

At the end of this course, the students should be able to:

1. Recognise a structural system that is stable and in equilibrium;

2. Determine the stress-strain relation for single and composite members based on Hooke's
   law;
3. Estimate the stresses and strains in single and composite members due to temperature changes;
4. Evaluate the distribution of shear forces and bending moments in beams with distributed
   and concentrated loads;
5. Determine bending stresses and their use in identifying slopes and deflections in beams;
6. Use Mohr's circle to evaluate the normal and shear stresses in a multi-dimensional stress system and transformation of these stresses into strains;
7. Evaluate the stresses and strains due to torsion on circular members; and
8. Determine the buckling loads of columns under various fixity conditions at the ends.

Course Content

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

GET 225: Fundamentals of Fluid Mechanics (3 Units C: LH 45)

Learning Outcomes

At the end of this course, the students should be able to:

1. Explain the properties of fluids;
2. Determine forces in static fluids and fluids in motion;
3. Determine whether a floating body will be stable;
4. Determine the effect of various instruments, (valves, orifices, bends and elbows) on fluid flow in pipes;
5. Measure flow parameters with venturi meters, orifice meters, weirs and others;
6. Perform calculations based on principles of mass, momentum and energy conservation;
7. Perform dimensional analysis and simple fluid modelling problems; and
8. Specify the type and capacity of pumps and turbines for engineering applications.

Course Content

Fluid properties, hydrostatics, fluid dynamics using principles of mass, momentum and energy conservation from a control volume approach. Flow measurements in pipes, dimensional analysis and similitude, 2-dimensional flows. Hydropower systems.

GET 226: Electrical and Electronics Engineering Laboratory (1 Unit C: PH 45)

Learning Outcomes

At the end of this course, the students should be able to:

1. Verify the various dc and ac network theorems;
2. Perform simple experiments on Resistance, Inductance and Capacitance measurements;
3. Measure and determine voltage, current and power in 3-phase star/delta connections;
4. Identify dc generator excitation methods and load characteristics of a separately excited dc motor; and
5. Perform open and short circuit tests of a transformer.

Course Content
Resistance measurement; Condition for maximum power transfer; inductance and capacitance measurement; verification of network theorems; ac series circuits. Measurement of power and power factor, excitation of dc generator, load characteristics of a separately excited dc motor; open and short circuit tests for a transformer. Static characteristics of junction diode and transistor, Half and full wave rectification, determination of copper temperature coefficient by Wheatstone bridge, measurement of voltage, current and power in three phase star/delta connection, simple domestic installation practices.

GET 227: Engineering Laboratory II (1 Unit C: PH 45)
Learning Outcomes
At the end of the course, the students should be able to:

1. Determine the thermal conductivity of a given insulating material and metal rod;
2. Determine calorific values of coal and coke;
3. Study the flow of fluids through obstacles;
4. Determine young's Modulus of material;
5. Explain the melt mass flow rate MFR of Engineering materials;
6. Evaluate calorific value of coke using Bomb Calorimeter, proximate Analysis of coal and coke;
7. Modify the microstructure and mechanical properties of materials for improved performance in engineering applications;
8. Evaluate composite materials for enhanced structural and functional performance in engineering applications;
9. Understand the mechanisms of material degradation and perform tests to evaluate corrosion behavior and resistance for material selection and protection strategies; and
10. Experimentally investigate and analyze energy conversion processes, validate thermodynamic principles and enhance understanding of system behavior under various thermal conditions.

Course Content
Crystal structure of selected specimen (BCC, FCC, HCP). Crystal imperfection. Determination of solidification curve of selected metals. Heat treatment processes (annealing, normalizing). Heat treatment processes hardening and tempering. Microstructural examination of mild steel. Commination devices. Pneumatic conveying system for solids. Use of cyclone to separate solids from air stream. Introduction to different types of screening equipment. Determination of the thermal conductivity of a metallic rod. Determination of the thermal conductivity of an insulating powder. Determination of the thermal conductivity of a solid by the guarded hot plate method. Verification of the Stefen-Boltzmann constant for thermal conductivity. Mechanical test: Impact test, Tensile test, Hardness test, Fatigue test, Creep and Non-destructive test of engineering materials, testing of magnetic materials e.g. transformer cores, testing of insulators, cables and transformers coil and verification of P-N junction characteristics. Tensile tests on bars. Determination of young's modulus of rigidity of materials of close coiled helical spring and stiffness of spring. Radiation resistant spring. Proximate analysis and determination of the calorific value of coal and coke using Bomb Calorimeter. Composite materials, corrosion testing, entropy change during reversible and irreversible processes using heat exchanger.

GET 299: Students Industrial Work Experience I (3 Units C: 9 Weeks)
Learning Outcomes
SIWES I should provide opportunity for the students to:

1. Acquire industrial workplace perceptions, ethics, health and safety consciousness, inter-personal skills and technical capabilities needed to give them a sound engineering foundation;
2. Learn and practise basic engineering techniques and processes applicable to their specialisations;
3. Build machines, devices, structures or facilities relevant to their specific engineering programmes and applications; and
4. Acquire competence in technical documentation (log-book) and presentation (report) of their practical experiences.

Course Content

Practical experience in a workshop or industrial production facility, construction site or special centres in the university environment, considered suitable for relevant practical/industrial working experience but not necessarily limited to the student's major. The students are exposed to hands-on activities on workshop safety and ethics, maintenance of tools, equipment and machines, welding, fabrication and foundry equipment, production of simple devices; electrical circuits, wiring and installation, etc. (8-10 weeks during the long vacation following 200 level).

EEE 311: Electromagnetic Fields and Waves I (2 Units C: LH 30)

Learning Outcomes

Students will be able to:

1. State and explain the various electromagnetic laws;
2. Derive and explain Maxwell's equation in rectangular coordinates; and
3. Explain wave propagation mechanism in conductors and unbounded dielectric media.

Course Content

Review of electromagnetic laws in integral form, Gauss's 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. Conduction and displacement current. Maxwell's equations (in rectangular co-ordinates and vector-calculus notation). Derivation of Maxwell's equations, electromagnetic potential and waves. Poynting vector, boundary conditions. Wave propagation in good conductors, skin effect; plane waves in unbounded dielectric media.

EEE 312: Electric Circuit Theory I (2 Units C: LH 30)

Learning Outcomes

Students will be able to:

1. State, explain and apply circuit theorems to d.c. circuits;
2. Obtain the network response to certain input signals using phasor notations and diagrams;
3. State and apply Laplace transforms to solve passive circuits; and
4. Plot Bode diagrams of a given transfer function.

Course Content

Passive circuit elements: R, L, C, transformers; circuit theorems: Ohm's, KVL, KCL, loop current, node potential, superposition. Network response to step, ramp and impulses. Network functions: response to exponential, sinusoidal sources. Laplace transform and transfer functions: pole-zero configuration and application in solving circuits, resonance; two-port analysis and parameters.

EEE 313: Electrical Machines I (3 Units C: LH 30; PH 30)

Learning Outcomes

At the end of this course, the students should be able to:

1. Explain the basic features of transformers;
2. State and explain the transformer equation;
3. Explain the simplified equivalent circuits of transformer;
4. Calculate the losses and efficiency of transformer;
5. Classify and explain various types of DC motors;
6. Enumerate industrial applications of electrical machines and transformers;
7. Compute the losses and efficiency of induction motor;
8. Generate the equivalent circuit of synchronous motor;
9. Describe the principle of operation of synchronous machine;
10. Conduct open circuit and short circuit tests on a transformer;
11. Conduct tests on DC machines, Induction machines and synchronous machines; and
12. Draw conclusions from computed and graphical analysis.

Course Content

Electromagnetic conversion principle. Transformers: Features. Principles of operation. Equivalent circuit and Phasor diagram. Regulation, efficiency, and rating. Three phase delta/star connections. DC Machines: Classification and Principles of operation. Operating characteristics. Ratings, efficiency, and applications. Induction Machines: Three phase and single phase motors. Classifications. Theory and operation. Equivalent circuits and phasor diagrams. Operating characteristics, rating and efficiency. Synchronous Machine: Classification. Theory of operation. Equivalent circuits. Phasor diagram.

GET 311: Engineering Statistics and Data Analytics (3 Units C: LH 45)

Learning Outcomes

At the end of the course, the students should be able to:

1. Work with data from the point of view of knowledge convergence, machine learning and intelligence augmentation, which significantly raises their standard for engineering analysis (the approach forces them to learn statistics in an actionable way that helps them to see the holistic importance of data analytics in modern engineering and technology);
2. Anticipate the future with Artificial Intelligence while fulfilling the basic requirements of conventional engineering statistical programming consistent with their future careers;
3. Perform, with proficiency, statistical inference tasks with language or programming toolboxes such as R, Python, Mathematica or MATLAB and Design Expert to summarise analysis and interpretation of industry engineering data and make appropriate conclusions based on such experimental and/or real-life industrial data;
4. Construct appropriate graphical displays of data and highlight the roles of such displays in data analysis; particularly, the use of statistical software packages;
5. Plan and execute experimental programmes to determine the performance of programme-relevant industrial engineering systems and evaluate the accuracy of the measurements undertaken; and
6. Demonstrate mastery of data analytics and statistical concepts by communicating the results of experimental and industry-case investigations, critically reasoned scientific and professional analysis through written and oral presentation.

Course Content
Descriptive statistics, frequency distribution, populations and sample, central tendency, variance data sampling, mean, median, mode, mean deviation, percentiles, etc. Probability. Binomial, poison hyper-geometric, normal distributions, etc. Statistical inference intervals, test hypothesis and significance. Regression and correlation. Introduction to big data analytics and cloud computing applications. Introduction to the R language; R as a calculator; Vectors, matrices, factors, data frames and other R collections. Iteration and looping control structures. Conditionals and other controls. Designing, using and extending functions. The Apply Family. Statistical modelling and inference in R.

GET 312: Introduction to Artificial Intelligence, Machine Learning and Convergent Technologies (3 Units C: LH 45)
Learning Outcomes
At the completion of the course, the students are expected to be able:

1. Explain the meaning, purpose, scope, stages, applications and effects of artificial intelligence;
2. Explain the fundamental concepts of machine learning, deep learning and convergent technologies;
3. Demonstrate the difference between supervised, semi-supervised and unsupervised learning;
4. Demonstrate proficiency in machine learning workflow and how to implement the steps effectively;
5. Explain natural languages, knowledge representation, expert systems and pattern recognition;
6. Describe distributed systems, data and information security and intelligent web technologies;
7. Explain the concept of big data analytics, purpose of studying it, issues that can arise with a data set and the importance of properly preparing data prior to a machine learning exercise; and
8. Explain the concepts, characteristics, models and benefits, key security and compliance challenges of cloud computing.

Course Content
Concepts of human and artificial intelligence; artificial/computational intelligence paradigms; search, logic and learning algorithms. Machine learning and nature-inspired algorithms – examples, their variants and applications to solving engineering problems; understanding natural languages; knowledge representation, knowledge elicitation, mathematical and logic foundations of AI; expert systems, automated reasoning and pattern recognition; distributed systems; data and information security; intelligent web technologies; convergent technologies – definition, significance and engineering applications. Neural networks and deep learning. Introduction to python AI libraries.

GET 313: Engineering Mathematics III (3 Units C: LH 45)
Learning Outcomes
At the end of the course, the students should be able to:

1. Demonstrate a clear understanding of the course content, that is, possess a breadth of knowledge in the area covered;
2. Possess an in-depth knowledge upon which a solid foundation can be built in order to demonstrate a depth of understanding in advanced mathematical topics;
3. Develop simple algorithms and use computational proficiency;

4. Write simple proofs for theorems and their applications; and
5. Communicate the acquired mathematical knowledge effectively in speech, writing and collaborative groups.

Course Content

Linear Algebra. Elements of Matrices, Determinants, Inverses of Matrices. Theory of Linear Equations. Eigen Values and Eigen Vectors. Analytical Geometry. Coordinate Transformation. Solid Geometry. Polar, cylindrical and spherical coordinates. Elements of functions of several variables. Surface Variables. Ordinary Integrals. Evaluation of Double Integrals, Triple Integrals, Line Integrals and Surface Integrals. Derivation and Integrals of Vectors. The gradient of scalar quantities. Flux of Vectors. The curl of a vector field, Gauss, Greens and Stoke's theorems and applications. Singular Valued Functions. Multivalued Functions. Analytical Functions. Cauchy Riemann's Equations. Singularities and Zeroes. Contour Integration including the use of Cauchy's Integral Theorems. Bilinear transformation.

GET 314: Engineering Laboratory III (1 Unit C: PH 45)

Learning Outcomes

By the end of this course, students will be able to:

1. Understand the architecture and components of AI-enabled IoT systems;
2. Interface and deploy sensors and devices for real-time data collection;
3. Apply machine learning models for processing and analyzing IoT data;
4. Design intelligent systems that adapt and respond to sensed data;
5. Implement cloud and edge-based analytics pipelines; and
6. Evaluate the ethical, security and privacy aspects of AIoT solutions.

Course Content

Introduction to IoT, AI and Data Analytics: Concepts and Trends. IoT Architecture and Protocols (MQTT, HTTP, CoAP). Sensors, Actuators and Embedded Platforms (Arduino, ESP32, Raspberry Pi). Data Acquisition, Signal Conditioning, and Streaming. Cloud and Edge Computing for IoT. Introduction to Machine Learning: Concepts and Tools (Python, Scikit-learn). Supervised Learning: Regression and Classification on IoT Data. Unsupervised Learning: Clustering, Anomaly Detection. Real-Time Analytics and Dashboarding (Node-RED, Grafana, Power BI). AI at the Edge: TinyML, TensorFlow Lite, Model Deployment on Microcontrollers. Case Studies: Smart Homes, Healthcare, Predictive Maintenance. IoT Security, Data Privacy and Ethical Considerations. Project Planning and System Design. Final Project Development and Testing. Final Project Presentation and Demonstration.

ENT 312: Venture Creation (2 Units C: LH 15; PH 45)

Learning Outcomes

At the end of this course, students, through case study and practical approaches, should be able to:

1. Describe the key steps in venture creation;
2. Spot opportunities in problems and in high potential sectors, regardless of geographical location;
3. State how original products, ideas and concepts are developed;
4. Develop a business concept for further incubation or pitching for funding;
5. Identify key sources of entrepreneurial finance;
6. Implement the requirements for establishing and managing micro and small enterprises;
7. Conduct entrepreneurial marketing and e-commerce;
8. Apply a wide variety of emerging technological solutions to entrepreneurship; and

9. Appreciate why ventures fail due to lack of planning and poor implementation.

Course Content

Opportunity identification (sources of business opportunities in Nigeria, environmental scanning, demand and supply gap/unmet needs/market gaps/market research, unutilised resources, social and climate conditions and technology adoption gap). New business development (business planning, market research). Entrepreneurial finance (venture capital, equity finance, micro-finance, personal savings, small business investment organizations and business plan competition). Entrepreneurial marketing and e-commerce (principles of marketing, customer acquisition and retention, B2B, C2C and B2C models of e-commerce, First Mover Advantage, E-commerce business models and successful e-commerce companies). Small business management/family business: Leadership and Management, basic book keeping, nature of family business and family business growth model. Negotiation and business communication (strategy and tactics of negotiation/bargaining, traditional and modern business communication methods). Opportunity discovery demonstrations (business idea generation presentations, business idea contest, brainstorming sessions, idea pitching). Technological solutions (The concept of market/customer solution, customer solution and emerging technologies, business applications of new technologies – artificial intelligence (AI), virtual/mixed reality (VR), Internet of things (IoTs), blockchain, cloud computing, renewable energy. Digital business and e-commerce strategies.

GST 312: Peace and Conflict Resolution (2 Units C: LH 30)

Learning Outcomes

At the end of this course, students should be able to:

1. Analyse the concepts of peace, conflict and security;
2. List major forms, types and root causes of conflict and violence;
3. Differentiate between conflict and terrorism;
4. Enumerate security and peace building strategies; and
5. Describe the roles of international organisations, media and traditional institutions in peace building.

Course Content

The concepts of peace, conflict and security in a multi-ethnic nation. Types and theories of conflicts: ethnic, religious, economic, geo-political Conflicts; structural conflict theory, realist theory of conflict, frustration-aggression conflict theory; root causes of conflict and violence in Africa: indigene and settlers phenomenon, boundaries/boarder disputes, political disputes, ethnic disputes and rivalries, economic inequalities, social disputes, nationalist movements and agitations; selected conflict case studies – Tiv-Junkun, ZangoKartaf, chieftaincy and land disputes, etc. Peace building, management of conflicts and security: Peace and Human Development. Approaches to Peace and Conflict Management (religious, government, community leaders). Elements of peace studies and conflict resolution: Conflict dynamics assessment Scales: Constructive and Destructive. Justice and Legal framework: Concepts of Social Justice; The Nigeria Legal System. Insurgency and terrorism. Peace mediation and peace keeping. Peace and Security Council (international, national and local levels). Agents of conflict resolution – Conventions, Treaties Community Policing: Evolution and Imperatives. Alternative Dispute Resolution (ADR) (dialogue, arbitration, negotiation, collaboration, etc). The roles of international organizations in conflict resolution ((a) The United Nations, UN and its conflict resolution organs. (b) The African Union and Peace Security Council (c) ECOWAS in peace keeping). The media and traditional institutions in peace building. Managing post-

conflict situations/crises: Refugees. Internally Displaced Persons (IDPs); the role of NGOs in post-conflict situations/crises.

EEE 321: Electrical Power System Principles (2 Units C: LH 30; PH 30)

Learning Outcomes

At the end of the course, the student should be able to:

1. Mention various types of Power stations;
2. State the conditions for sitting Power stations;
3. Calculate inductances and capacitances of single-phase and three-phase lines;
4. Distinguish among short, medium and long transmission lines;
5. Derive the voltage–current relationship of the various line types;
6. Explain the polyphase theory;
7. Identify power system components and their applications;
8. Identify various measuring instruments and safety procedures in the Electrical Power Laboratory;
9. Conduct measurements on three phase circuits;
10. Carry out voltage and current measurements;
11. Draw conclusions from computed and graphical analysis; and
12. Prepare and present experimental reports.

Course Content

Types of power station, operation, auxiliaries, economics of operation-stations, substations power supply economics, tariffs, Power factor correction. Calculation of inductances of single-phase and three-phase lines. GMR and GMD. Bundled conductors. Calculation of capacitance of single-phase and three-phase lines. Current and voltage relations: Short, medium and long lines. Network equations and calculations: Power system components and equipment: Transformers. Polyphase theory. DC, AC power distribution, network calculations. Overhead line conductors. Corona effect, voltage control, circuit breakers, load forecast, sitting of generating plants.

EEE 322: Digital Electronic Circuits (2 Units C: LH 30)

Learning Outcomes

Students will be able to:

1. Classify, describe and discuss the various logic gates and flip-flops and multivibrators;
2. Design simple logic and sequential circuits using logic gates and flip-flops.
3. Design and modify electronic circuits using Karnaugh Maps; and
4. Discuss the applications of Flip-flops.

Course Content

Number Systems and Codes. Logic Gate Simplification of Logic expressions using Boolean algebra. Simplification of Logic expressions using Karnaugh Method. Design of combinational circuit. Flip-Flops. Application of Flip-Flops in the design of counter. Registers and timers. Switching and wave shaping circuits. Generation of non-sinusoidal signal (multivibrators). Introduction to ADC and DAC. Design of Logic Gates (Diode, DTL, TTL, ECL etc). Sequential circuits. Introduction to microprocessors.

EEE 323: Electric Circuit Theory II (2 Units C: LH 30)

Learning Outcomes

At the end of the course, students will be able to:

1. Analyse on-linear circuits using approximation methods;

2. State the conditions for reliability of transfer functions;
3. Design/synthesize RL, RC, LC and RLC circuits from given transfer functions; and
4. Design passive and active filters from transfer functions and performance specifications.

Course Content

Non-linear circuit analysis. Network functions, Locus diagrams. Circuit synthesis: reliability criteria, Foster and Cauer syntheses of RC, RL, LC and RLC circuits. Filters: design, operation, low, high, bandpass. Butterworth and Chebychev filter design. Active network analysis and synthesis.

EEE 324: Analogue Electronic Circuits I (2 Units C: LH 30)

Learning Outcomes

Students will be able to:

1. Classify, describe and discuss the principles of operation and applications of FET and BJT;
2. Calculate amplifier parameters; and
3. Design simple amplifiers using BJT and FET with given specifications.

Course Content

Single-stage transistor amplifiers using BJT and FET Equivalent circuits and calculation of current gain, voltage gain, power gain, input and output impedance. Operational Amplifiers: Description, parameters and applications. Feedback, broadband and narrowband amplifiers. Power amplifiers. Voltage and current stabilizing circuits. Voltage amplifiers, multi-stage amplifiers using BJTs and FETs.

GET 321: Engineering Economics (3 Units C: LH 45)

Learning Outcomes

At the end of the course, the student should be able to:

1. Understand the importance of economics/fundamental economic concepts (supply/demand, costs/benefits and time value of money) to engineering decisions such as project selection, technology adoption and asset replacement;
2. Evaluate projects using various economic methods and mathematical programming models like present value, net present value, internal rate of return, and discounted cash flow analysis;
3. Understand the importance of budgeting, financial forecasting, depreciation accounting, cost control and other financial principles for engineering projects; and
4. Analyze the economic feasibility of different engineering designs and solutions, develop ability to assess the economic impact of engineering decisions on various stakeholders and make economic decisions under uncertainty and in complex decision-making environments

Course Content

The nature and scope of economics. Basic concepts of engineering economy- Relationship between Science, Engineering, Technology and Economics. Theories of Maximization-Profit Maximization, Growth Maximization, Sales Revenue Maximization, Utility Maximization and Wealth Maximization. Theory of Demand-Demand schedule, Nature and characteristics of demand, Law of demand, Limitations to the law of demand, Elasticity of Demand: Price, Income and Cross elasticity. Demand Forecasting definition, factors determining demand forecasting, methods of demand forecasting. Cost Concepts-Types of costs: Fixed cost, Variable cost, Average cost, Marginal cost, Real cost, Opportunity cost, Accounting and

Economic cost. Cost - Volume profit analysis, Break - Even analysis, Operating leverage. Interest formulae, discounted cash flow, present worth, equivalent annual growth and rate of return comparisons. Replacement analysis. Benefit-cost analysis. Minimum acceptable rate of return. Accounting Concepts-Double Entry System, Journal, Ledger, Trail balance, Final Accounts Book Keeping System, Depreciation-Definition, functions, methods of depreciation; Straight line, Declining balance; Sum of years digits method. Judging attractiveness of proposed investment.

GET 322: Technical Writing and Communication (3 Units C: LH 45)

Learning Outcomes

At the end of the course, the student should be able to:

1. Demonstrate the concept of clear writing, common pitfalls and unambiguous language in engineering communication, including technical reporting for different applications and emotional comportment;
2. Demonstrate the skills of language flexibility, formatting, logic, data presentation styles, referencing, use of available aids, intellectual property rights, their protection and problems in engineering communication and presentation; and
3. Demonstrate good interpersonal communication skills through hands-on and constant practice on real-life communication issues for engineers in different sociocultural milieu for engineering designs, structural failure scenarios and presentation of reports.

Course Content

A brief review of common pitfalls in writing. Principles of clear writing (punctuations and capitalization). Figures of speech. Units of grammar. Tenses and verb agreement. Active and passive sentences Lexis, structure Fog and Index concept. Skills for communication and communication algorithm. Types and goals of communication; Interpersonal communication; features and the Finger Model or A, B, C, D, E of good interpersonal communication (accuracy of technical terms, brevity of expression, clarity of purpose, directness of focus and effectiveness of the report). Language and organisation of reports. Technical report writing skills (steps, problems in writing, distinguishing technical and other reports, significance, format and styles of writing technical reports). Different formats for communication; styles of correspondences – business report and proposal, business letter, memorandum, e-mails, etc. Proposals for projects and research; format, major steps and tips of grant-oriented proposals. Research reports (competency, major steps, components and formats of research reports and publishable communication). Sources and handling of data, tables, figures, equations and references in a report. Presentation skills; overview, tips, organisation, use of visual aids and practising of presentation. Intellectual property rights in research reports. Case studies of major engineering designs, proposals and industrial failures with professional presentation of reports.

GET 323: Engineering Mathematics IV (3 Units C: LH 45)

Learning Outcomes

At the end of the course, the students should be able to:

1. Solve second order differential equations;
2. Solve partial differential equations;
3. Solve linear integral equations;
4. Relate integral transforms to solution of differential and integral equations;
5. Explain and apply interpolation formulas; and
6. Apply Runge-Kutta and other similar methods in solving ODE and PDEs.

Course Content
Series solution of second order linear differential equations with variable coefficients. Bessel and Legendre equations. Equations with variable coefficients. Sturn-Louville boundary value problems. Solutions of equations in two and three dimensions by separation of variables. Eigen value problems. Use of operations in the solution of partial differential equations and Linear integral equations. Integral transforms and their inverse including Fourier, Laplace, Mellin and Handel Transforms. Convolution integrals and Hilbert Transforms. Calculus of finite differences. Interpolation formulae. Finite difference equations. Runge-Kutta and other methods in the solutions of ODE and PDEs. Numerical integration and differentiation.

GET 324: Renewable Energy Systems and Technology (3 Units C: LH 30; PH 45)
Learning Outcomes
At the end of the course, the students should be able to:

1. Identify the types, uses and advantages of renewable energy in relation to climate change;
2. Design for use the various renewable energy systems;
3. Recognise and analyse the current energy systems in Nigeria, their impacts on development and the global energy demand and supply scenarios;
4. Appreciate the environmental impact of energy exploitation and utilization, and pursue the sustainable development of renewable energy for various applications; and
5. Recognise the exploitation, excavation, production, and processing of fossil fuels such as coal, petroleum and natural gas, and discuss the sources, technology and contribution to future energy demands of renewable energy.

Course Content
Current and potential future energy systems in Nigeria and globally - resources, extraction, concepts in energy conversion systems; parallels and differences in various conversion systems and end-use technologies, with emphasis on meeting 21st-century national, regional and global energy needs in a sustainable manner. Various energy technologies in each fuel cycle stage for fossil (oil, gas, synthetic), nuclear (fission and fusion) and renewable (solar, biomass, wind, hydro, and geothermal). Energy types, storage, transmission and conservation. Analysis of energy mixes within an engineering, economic and social context. Sustainable energy; emphasise sustainability in general and in the overall concept of sustainable development and the link this has with sustainable energy as the fundamental benefit of renewable energy.
Practical Contents: Simple measurement of solar radiation, bomb calorimeter determination of calorific value of fuels and biomass; measurement of the velocity of wind, waves and the energy that abound in them; laboratory production of biogas and determination of energy available in it; simple conversion of solar energy to electricity; trans-esterification of edible oil into biodiesel; simulation of geothermal energy; Geiger-Muller or Scintillation Counters' determination of uranium or thorium energy; simple solid or salt storage of energy; hybrid application of renewable energy.

GET 399: Students Industrial Work Experience II (4 Units C: 12 Weeks)
Learning Outcomes
At the end of the SIWES, students should be able to:

1. Demonstrate proficiency in at least any three softwares in their chosen career choices;
2. Demonstrate proficiency in some animation videos (some of which are free on YouTube) in their chosen careers;
3. Carry out outdoor hands-on construction activities to sharpen their skills in their chosen careers;

4. Demonstrate proficiency in generating data from laboratory analysis and develop empirical models;
5. Demonstrate proficiency in how to write engineering reports from lab work;
6. Fill logbooks of all experience gained in their chosen careers; and
7. Write a general report at the end of the training.

The experience is to be graded and the students must pass all the modules of the attachment and shall form part of CGPA.

Course Content

On-the-job experience in industry chosen for practical working experience but not necessarily limited to the student's major (Students are to proceed on three months of work experience i.e. 12 weeks during the long vacation following 300 level). Students are engaged in the more advanced workshops, indoor software design training similar to what they will use in the industry and outdoor construction activities to sharpen their skills. The use of relevant animation videos that mimic industrial scenarios is encouraged. Students are to write a report at the end of the training. As much as possible, students should be assisted and encouraged to secure 3 months placement in the industry. Examples of outline of activities and experiences to which students are expected to be exposed to earn prescribed credits include:

Section A: Welding and fabrication processes, automobile repairs, · lathe machine operations: machining and turning of simple machine elements, such as screw threads, bolts, gears, etc. Simple milling machine operations, machine tool maintenance and trouble-shooting, and wooden furniture making processes.

Section B: Mechanical design with computer graphics and CAD modelling and drafting. Introduction to Solidworks: software capabilities, design methodologies and applications. Basics part modelling: sketching with SolidWorks, building 3D components, using extruded Bose base · Basic assembly modelling, and solidWorks drawing drafting. Top-down assembly technique exploded view, exploded line sketch. Introduction to PDMS 3D design software; autoCAD mechanical, SPSS.

A comprehensive case study design project. The student should be introduced to the concept of product/component design and innovation and then be given a comprehensive design project.

Examples of projects should include the following:

a. Design of machine components;
b. Product design and innovation;
c. Part modelling and drafting in SolidWorks; and
d. Technical report writing.

EEE 411: Electromagnetic Fields and Waves II (2 Units C: LH 30)

Learning Outcomes

At the end of this course, the students should be able to:

1. Understand the electromagnetic power and energy relations as well as its practical applications;
2. Apply the principles of magneto statics to the solutions of problems relating to magnetic field and magnetic potential, boundary conditions and magnetic energy density; and
3. Apply Maxwell's equations to solutions of problems relating to transmission lines and uniform plane wave propagation.

Course Content

Power Density and Energy Relations. Duality and Doppler effects. Polarization of Plane Wave. Reflection: Reflection from perfect conductors and Transmission of plane waves.

Electromagnetic potential and antipotentials. Electromagnetic (EM) radiating systems: near the far fields. Waveguides, Electromagnetic interference and compatibility. Electromagnetic modeling by finite element methods.

EEE 412: Reliability and Maintainability of Electrical and Electronic Components (2 Units C: LH 30)

Learning Outcomes

At the end of this course, the students should be able to:

1. Determine the reliability, maintainability and availability of electronic and electric power components using elementary statistics and probability theory;
2. Explain the failure rate of electronics and electric power components;
3. Show how mathematical models of system availability are constructed and how system availability and reliability parameters can be estimated;
4. Explain how systems can survive failures and how system maintenance can be made easier;
5. Develop hardware and software availability enhancement and correct handling of fault after it is detected, so as to reduce downtime.

Course Content

Introduction to: Reliability. Maintainability and Availability. Elementary reliability theory. Application to power system components. Application to electronic components. Test characteristics of electrical components. Test characteristics of electronic components. Types of faults. Designing for higher reliability. Packaging. Mounting. Ventilation. Protection from humidity and dust.

EEE 413: Electrical Machines II (2 Units C: LH 30)

Learning Outcomes

At the end of this course, the students should be able to:

1. Determine transformer equivalent circuits;
2. Solve numerical problems for computation of losses and efficiency of Transformers;
3. Explain the conditions for parallel operations of Transformers;
4. Describe various methods of starting Induction motor;
5. Explain methods of speed control of Induction motor;
6. Draw and explain power flow diagram of Induction motor;
7. Determine the synchronous impedance of Synchronous motor;
8. Derive power and torque equation of synchronous motor;
9. Explain voltage regulation, V-curves and parallel operation of Synchronous Generators; and
10. Solve practical electrical machine problems using MATLAB/Simulink.

Course Content

Three-phase transformers: The Complete Transformer Model. Transformer tests and determination of transformer parameters. Transformer Efficiency. Separation of core losses. Parallel operation of Transformer. Auto-Transformers.

Induction motors: Speed/Torque Characteristics as an induction motor. Testing of Induction motors. Single-phase induction motors. Induction motor power flow diagram. Starting methods of Induction motor. Induction motor speed control. Synchronous motor: Synchronous machine equivalent circuit. Synchronous machine tests. Synchronous machines connected to the Grid. Power angle characteristics of a synchronous machine. Voltage Regulation. Determination of Synchronous impedance, V-Curves, Power and Torque equations of Synchronous machine.

Synchronous Generator. Parallel operations. Solving Electrical machines problems with MATLAB/SIMULINK.

EEE 414: Communication Principles (3 Units C: LH 30; PH 45)

Learning Outcomes

At the end of this course, the students should be able to:

1. Explain the concept of random processes and their parameters;
2. Discuss the Hilbert transform and Markov processes and their applications in digital systems;
3. Discuss the different types of digital modulation techniques and their characteristic features, including spread spectrum schemes;
4. Identify various measuring instruments and safety procedures in the Digital and Communication Laboratory;
5. Carry out Logic circuit tests;
6. Distinguish between Synchronous and Asynchronous counters;
7. Apply Modulators and Demodulators in communications;
8. Design D/A and A/D converters; and
9. Prepare and present experimental reports.

Course Content

Review of probability: Basic Concepts, Conditional and total probability, distribution and density functions. Random variables: single and multiple variables, mean variance and moments. Basic concepts, definition and classification of random processes. Stationary process and independence property. Autocorrelation and correlation functions. Ergodicity and Power density spectrum. Hilbert Transforms and Noise modelling. Linear system response to random signal. Narrowband, band-limited and band-pass processes. Optimal linear systems: matched filter for white noise and coloured noise, Wiener filters, minimum mean-squared error. Optimisation by parameter selection, Poisson points and renewals. Markov processes. Applications of random signal theory in communications. Digital modulation techniques: ASK, FSK, PSK, DPSK, M-ary modulation, continuous phase FSK, MSK, QAM, DSL Schemes. Line coding, Intersymbol Interference (ISI), Nyquist wave shaping, eye pattern, adaptive equalisation. Transmission over bandpass channel. Spread spectrum communications: pseudo noise sequences, direct sequence spread spectrum, frequency hopping spread spectrum, CDMA, application examples.

EEE 415: Digital Electronics Laboratory (1 Unit C: PH 45)

Learning Outcomes

At the end of this course, the students should be able to carry out experiments on logic circuits, flip-flops, registers and counters.

Course Content

Logic modules, Logic circuits, shift registers, shift counters, ring counters, single-latch and clocked flip-flops, synchronous and asynchronous counters, up-down counters, codes and code converters, state machines.

EEE 416: Signals and Systems (2 Units C: LH 30)

Learning Outcomes

At the end of this course, the students should be able to:

1. Identify and list the characteristics, properties and types of signals and systems and describe their application in various engineering disciplines;
2. Describe various system properties e.g. time invariance, linearity;
3. Analyse systems and signals using Fourier, Laplace and Z-transforms;
4. Identify effective control strategies towards effective sensitivity analysis;
5. Apply the necessary mathematical tools to model, analyze and design signals and systems in both time-domain and frequency domain;
6. Recognize the broad applicability of the mathematics of signals and systems theory especially in Electrical Engineering; and
7. Know or identify the similarities and differences between mathematical tools needed for dealing with continuous-time signals and discrete-time signals.

Course Content

System modeling. Analog signals. Convolution and correlation. Fourier and Laplace Transforms. Random processes. Sampled signals and systems. Discrete Fourier transforms. Z transforms. Analog and Digital filters. Control strategies. Open-loop, feed forward and feedback control systems. Stability, performance and sensitivity analyses. Lag Engineering and Technology. Lead compensation, Frequency domain design, PID controllers. Elements of nonlinear control.

EEE 417: Control Systems Engineering I (3 Units C: LH 30; PH 45)

Learning Outcomes

At the end of this course, the students should be able to:

1. Identify and describe various examples of control systems;
2. Analyze control systems in time and frequency domains;
3. Perform stability analysis using Routh Hurwitz, Root Locus Bode and Nyquist stability criteria;
4. Describe and illustrate compensation techniques;
5. Use MATLAB/SIMULINK, PYTHON in solving control systems problems;
6. Carry out control system response measurements; and
7. Draw conclusions from computed and graphical analysis.

Course Content

Review of mathematical tools-Laplace Transform. Basic concepts and examples of control systems. Classification of control Systems. General Transfer Function for control systems. Stability Criteria by the Routh method. Systems description. First order Systems. Second order systems. Frequency and Time domains analysis of Control systems. Bode plots and Nyquist Stability criteria. Error constants. Compensation techniques: P, PI, PD and PID. Introduction to non-linear control systems. Linearization of non-linear systems. Concept of controllability and observability. Modern control observers. Application of Matlab/Simulink, Python software in Control Systems Engineering.

EEE 418: Measurement and Instrumentation (3 Units C: LH 30; PH 45)

Learning Outcomes

At the end of this course, the students should be able to:

1. Analyse the performance characteristics of each instrument;
2. Illustrate basic meters such as voltmeters and ammeters;
3. Explain about different types of signal analyzers;
4. Explain the basic features of oscilloscope and different types of oscilloscopes;

5. Apply the complete knowledge of various electronics instruments/transducers to measure the physical quantities in the field of science, engineering and technology;
6. Identify various measuring instruments and safety procedures in the Measurement and Instrumentation Laboratory;
7. Conduct DC and AC measurements;
8. Draw conclusions from computed and graphical analysis; and
9. Prepare and present experimental reports.

Course Content

General Instrumentation. Basic meter in DC measurements. Basic meter in AC measurements. Rectifiers, Voltmeters, Electro-dynamometer and Wattmeter. Instrument transformers, DC and AC Bridges. Universal Impedance Bridge. Electronic Instruments for the measurement of voltage, current resistance and other circuit parameters. Electronic Voltmeters, AC voltmeters and Multimeters. Oscilloscopes. Vertical and horizontal deflection systems. Probes. Sampling CRO. Instruments for generating and analyzing waveforms; Square wave analyzers, electronic counters and their applications. Time base circuitry. Analog and Digital data acquisition system. Tape recorders. D/A and A/D conversions.

EEE 421: Industrial Visit and Technical Presentation (2 Units C: 1 day Visit)

Learning Outcomes

At the end of this course, the students should be able to:

1. Hold intelligent discussions on the trends of research and engineering advancement;
2. Explain the operation of an identified and visited Industry; and
3. Present technical reports in both oral and written format.

Course Content

This course is designed to allow discussion of projects, research and industrial related projects by both staff and students. By so doing, the students are exposed to the techniques of how to present scientific ideas and technical reporting. At the end of the course, students are expected to present their technical reports in both oral and written form.

GET 421: Engineering Project I (2 Units C: PH 90)

Learning Outcomes

At the end of this course, the students should be able to:

1. Complete the design phase of a complex engineering problem sourced from industry or community during the SIWES III programme; and
2. Demonstrate the connection between engineering product-making and the theoretical courses they have learned following the applicable industry best practices.

Course Content

In the second semester of the 400-level students, preferably in groups, work from the University on the identified industry or organization to tackle industry complex engineering problems. Theoretical issues may be provided by the department faculty or industry experts. During the vacation, students will now work full time with the organisation/industry on the project as part of the SIWES III. The students can also go beyond the department and engage in multidisciplinary undertakings. Literature survey, review of existing systems etc. must be achieved to a satisfactory extent.

GET 422: Engineering Valuation and Costing (2 Units C: LH 30)

Learning Outcomes

At the end of this course, the students should be able to:

1. Identify at least three (3) objectives of engineering valuation work, Valuer's primary duty
   and responsibility and valuation terminologies;
2. Describe at least four (4) Valuer's obligation to his or her client, to other Valuers and to
   the society;
3. Demonstrate with example the engineering valuation methods, valuation standards and Practices;
4. Prepare engineering valuation and appraisal reports and review;
5. Discuss expert witnessing and ethics in valuation; and
6. Determine price, cost, value, depreciation and obsolescence in real property, personal property, personal property, machinery and equipment, oil, gas, mines and quarries valuation.

Course Content

Objectives of valuation work/ valuer's primary duty and responsibility. Valuer's obligation to his or her client, to other valuers and to the society. Valuation methods and practices. Valuation reports. Expert witnessing. Ethics in valuation. Valuation standards. Price, cost and value. Depreciation and obsolescence. Valuation terminology. Real asset valuation; personal asset valuation. Machinery and equipment valuation. Oil and gas facilities valuation. Mines and quarries valuation. Appraisal reporting and review.

GET 499: Students Industrial Work Experience III (4 Units C: 12 Weeks)

Learning Outcomes

Students on Industrial Work Experience Scheme (SIWES) are expected to:

1. Be exposed and prepared for the Industrial work situation they are likely to meet after graduation, by developing their occupational competencies;
2. Bridge the existing gap between theory and practice of programmes through exposure to real-life situations, including machines and equipment handling, professional work methods and ethics, human relations, key performance assessment methods and ways of safeguarding the work environment – human and materials;
3. Experience/simulate the transition phase of students from school to the world of work and the environment seamlessly and expose them to contacts for eventual job placements after graduation;
4. Be motivated to identify the industrial and practice engineering challenges of their place of engagement and the larger society and creatively device impactful solutions to them; and
5. Exploit the opportunity to improve and utilise their acquired critical thinking and innate creativity skills, during the program and SIWES Seminar presentation respectively.

Course Content

On-the-job experience in industry chosen for practical working experience but not necessarily limited to the student's major (24 weeks from the end of the first semester at 400-Level to the beginning of the first semester of the following session. Thus, the second semester at 400-Level is spent in industry). Each student is expected to work in a programme related industry, research institute or regulatory agencies etc., for a period of 6 months under the guidance of appropriate personnel in the establishment but supervised by an Academic Staff of the Department. On

completion of the training, the student submits the completed Log book on the experience at the establishment. Also, there will be a comprehensive report covering the whole of the student's industrial training experiences (GET 299, GET 399 and GET 499), on which a seminar will be presented to the Department for overall assessment.

EEE 510: Electrical Services Design (2 Units C: LH 30)

Learning Outcomes

At the end of this course, the students should be able to:

1. State Illumination Laws;
2. Describe and Compute Luminous flux and luminous intensity
3. Design lighting installation;
4. Carry out energy audit;
5. Describe method of Earthing and testing of Electrical installation;
6. Identify Energy audit instruments;
7. Identify cable types and wiring accessories; and
8. Describe adequate protection scheme.

Course Content

Lightning installation, power installation, energy supply and distribution, choice of cables and conductors, wiring systems and accessories, outdoor low voltage lines and cables. Protection of low voltage installation and characteristics of low voltage equipment. Earthing and testing of electrical installation. Illumination. Polar curves. Lumen method. Aim of energy Audit. Energy Flow diagram. Energy Audit of Electrical System. Energy Audit of Heating, Ventilation and Air Conditioning Systems. Strategy of Energy Audit. Instruments for Energy Audit.

EEE 511: Telecommunications Engineering (2 Units C: LH 30)

Learning Outcomes

At the end of this course, the students should be able to:

1. Describe the telecommunications standard and regulatory issues;
2. Explain network planning and dimensioning to minimize data loss and delay;
3. Explain spectrum management and regulatory body involvements;
4. Discuss radio planning, spectrum policy and allocation procedures at various levels; and
5. Discuss the role of integrated data and environment in networks for optimum performance.

Course Content

Engineering and Technology. New Telecommunication standards, monitoring and regulation: International Telecommunications Union (history, structure and functions). Global telecommunications standards collaboration: international and regional. Nigerian Communications Act. Nigerian Communications Commission. Spectrum Management: basics of spectrum management: RF spectrum, classifications and features, spectrum utilization, need for spectrum management, spectrum management goals. Spectrum management functions. Spectrum policy, planning and assignment: frequency assignment and allocation procedures, national, regional and international spectrum management regulatory frameworks. Spectrum management applications (e.g. aeronautics, radio astronomy, radar, broadcasting, satellite networks, etc.). Spectrum management responsibilities: spectrum management improvement techniques, ITU's radio regulation and recommendations, ITU-R activities and study groups,

CEPT, ETSI, NTIA, Ofcom, Nigerian Communications Commission (NCC), spectrum management in selected developing countries.

EEE 512: Electric Power Systems Engineering (2 Units C: LH 30)

Learning Outcomes

At the end of this course, the students should be able to:

1. Generate single line diagram of Power systems;
2. Carry out load flow analysis;
3. Explain symmetrical and unsymmetrical faults;
4. Outline and describe power systems protection schemes; and
5. Discuss issues in the deregulation of power systems in Nigeria.

Course Content

Basic Concepts: Review of basic concepts of three-phase power and reactive power flow. Single line and reactance diagram of power systems. Per-unit representation. An overview of power system. Load Flow Analysis: Representation of power system. Bus admittance matrix. Power flow equations. Power-flow solutions by Gauss-Seidel and Newton-Raphson methods, Sparcity Techniques, Decoupled and fast decoupled methods. Symmetrical and
Unsymmetrical Faults: Transients in series R-L circuit. Internal voltages of loaded machines under fault conditions. Symmetrical fault, Z-bus and fault analysis using Z-bus. Symmetrical components, Sequence networks. Unsymmetrical faults: single line-to-ground fault, line-to-line fault and double line-to-ground fault. Stability studies.

EEE 513: Optical and Satellite Communication (2 Units C: LH 30)

Learning Outcomes

At the end of this course, the students should be able to:

1. Explain the configuration and architecture of optical communication system;
2. Analyze system based on important parameters for characterizing optical fiber, optical source, detector and amplifier;
3. Analyze the techniques and design methodology of optical fiber system, calculate and simulate the important design parameters;
4. Describe the high-bit-rate data transmission and free-space optical communications systems for deep space application;
5. Determine the location of a satellite in space;
6. Explain Kepler's laws vis-à-vis their application to the location of satellite in orbit;
7. Differentiate between Earth segment and Space segment of a satellite communication system;
8. Design a satellite uplink and downlink; and
9. Identify the different techniques and trade-offs employed in communicating signals through a satellite.

Course Content

Optical transmitting devices, LEDs optical receivers, optical fibres/types, features, joining, coupling. Deep space communication system/capacity, reliability economy/application of Pulse-code Modulation (PCM) and a Differential Pulse-code modulation (DPCM) concepts. Orbital equations for satellites in space. Kepler's laws of planetary motion. Space segment-based satellite subsystems including: Altitude and Orbit Control System (AOCS). Telemetry. Tracking. Command (TTC) system. Power Subsystem, Communication Subsystem and Antenna Subsystem. System noise temperature. Gain to noise (G/T) ratio, Downlink design, Uplink design and design for specified carrier-to-noise ratio (C/N). Design examples. Analogue

and Digital modulation techniques employed in satellite communications including: Frequency Modulation (FM) transmission by satellite and Single Channel Per Carrier (SCPC) FM links. Digital transmission and Modulation/Demodulation and Digital transmission of analogue signals. Various multiple access schemes relevant to satellite communications: Frequency Division Multiple Access (FDMA), Time Division MA, Code Division MA, Spread Spectrum Transmission and Reception. Very Small Aperture Terminal (VSAT) systems. Their network architectures, Access control protocols, Basic techniques and VSAT Earth Station engineering.

EEE 514: High Voltage Engineering (2 Units C: LH 30)

Learning Outcomes

At the end of this course, the students should be able to:

1. Describe the structures and operations of high voltage equipment;
2. Show how to generate high a.c. and d. c. voltages;
3. Deploy high voltage equipment to carry out tests on electric power apparatus and obtain the withstand voltage;
4. Explain overvoltage occurrences in power system – corona and overvoltage due to switching, lightning etc.;
5. Explain how protective devices such as lightning arrester works and how they protect high voltage power system equipment; and
6. Explain the properties of insulators, and basic insulation level of power apparatus.

Course Content

Generation and measurement of high voltages. Generation and measurement of high currents. Voltage multipliers. Van-de-Graff generators. Impulse voltages and currents. Breakdown theories of: gaseous dielectrics, Liquid dielectrics and Solid dielectrics. Lightning phenomena. High voltage equipment. Insulation co-ordination. Lighting protection. Electric cables and condenser. Measurement of D.C. resistivity. Dielectric constant and loss factor. Testing of insulators and bushings. Testing of cables, circuit breakers, transformers and surge diverters.

EEE 515: Industrial Electronic Design (2 Units C: LH 30)

Learning Outcomes

At the end of this course, the students should be able to:

1. Explain basic elements of Industrial motor control;
2. Determine the use of different control devices and motor starters;
3. Describe the application of solid-state devices in circuits;
4. Discuss the application of programmable controllers, thyristors, lasers and fiber optics in the control of industrial processes;
5. Understand electronic Control of DC and AC Motors; and
6. Understand the theory of robotics and other motion control systems.

Course Content

Solid-state devices and circuits. Programmable controllers. Thyristors. Lasers. Fiber optics. Power supplies. Op-amp circuits. Open-loop (feedback) systems. Closed-loop feedback systems. Input devices. Output devices. AC Motors. DC motors. Motor control devices. Robots. Other motion control systems. Data communications.

EEE 516: Electrical Machine Design (2 Units C: LH 30)

Learning Outcomes

At the end of this course, the students should be able to:

1. Explain fundamental concepts of heating and temperature effects on electrical devices;

2. Describe the layout of A.C. and D.C. winding designs;
3. Design different kinds of electrical machines theoretically;
4. Apply computer simulation tools in the design of electrical machines, for practical implementations; and
5. Predict and interpret machine performances from FEA softwares.

Course Content

Electric machine construction. Cables and magnetic cores. Insulating materials and their specification. Cooling. Heating and temperature rise data/curve. Ventilation/cooling curves. Winding arrangements. Flux flow and distribution in the cores for different windings. Flux wave approximations. Flux wave calculations. Basic principles of electric machine design using machine output and dimensions: Design of inductors. Design of transformers. Design of dc machines. Design of induction motor. Design of synchronous machines. Determination of machine core shapes and dimension, winding cable current rating, insulation and cooling specifications for given output rating. Computer applications to design of electrical machines, using simulation software.

EEE 517: Control Systems Engineering II (2 Units C: LH 30)

Learning Outcomes

At the end of this course, the students should be able to:

1. To understand the fundamental concepts of control systems, including open-loop and closed-loop systems, feedback mechanisms and their significance in engineering applications (Introduction to Control Systems);
2. To develop skills to represent physical systems using mathematical models such as transfer functions and state-space representations for electrical, mechanical and electromechanical systems (Mathematical Modeling of Systems);
3. To analyze the behavior of control systems in time and frequency domains using tools like step response, impulse response, Bode plots and Nyquist plots (System Analysis in Time and Frequency Domains);
4. To learn methods to determine system stability through techniques such as the Routh-Hurwitz criterion, root locus analysis and Nyquist stability criterion (Stability Analysis);
5. To gain proficiency in designing and tuning controllers like PID to meet specific system performance criteria (Design and Tuning of Controllers);
6. To master state-space analysis methods to examine multi-input, multi-output (MIMO) systems and understand controllability, observability and state feedback (State-Space Techniques);
7. To explore compensation techniques including lead, lag and lead-lag compensators to enhance system performance and achieve desired specifications (Compensation Techniques);
8. To understand the principles of digital control, including sampling theory, z-transform techniques and the design of discrete-time controllers (Digital Control Systems);
9. To learn optimization techniques to improve system performance metrics like speed, accuracy and energy efficiency (System Optimization);
10. To apply theoretical knowledge to practical problems using software tools like MATLAB/Simulink to model, simulate and design control systems for real-world engineering problems (Practical Applications and Simulation); and
11. To extend state-space analysis and gain an appreciation of recent advances in control engineering, such as pole assignment, observers design, introduction to optimal, adaptive and identification techniques.

Course Content

1. State-space analysis: Linear systems with multiple eigenvalues,
2. Nonlinear state-space representation
3. Linearization and Jacobian matrices,
4. Decomposition of system into controllable and uncontrollable parts
5. Deadbeat response-pole assignment with state and with output feedback
6. Introduction to advanced control topics: optimal control. Adaptive control systems.
7. System identification of dynamic systems, least squares,
8. Process Control: Introduction to Process Control, PID, PID Controller Tuning, PID Controller Implementation Programmable Logic Control: The Software Environment and Programming of PLC.

EEE 518: Fundamentals of Electric Vehicles (2 Units E: LH 30)

Learning Outcomes

At the end of this course, the students should be able to:

1. Explain what rolling and grading resistances are and their effects on vehicle speed.
2. State aerodynamic considerations on the vehicle;
3. Evaluate the maximum speed, acceleration force and torque required on drive wheel.
4. Design and develop the body and chassis of Electric Vehicle;
5. Identify issues to high efficiency of transmission and possible remedies;
6. Explain the purpose for the emergence of EVs and their starting point, possibly.
7. Demonstrate the difference between EVs and fossil-fuel vehicles;
8. Describe the basic architecture and characteristics of drivetrain of EVs;
9. Explain the environmental impact of EVs in terms of their eco-friendliness; and
10. Design the motion and dynamism of the vehicle with existing scientific laws.

Course Content

A brief history of Electric Vehicles. Electric Vehicle Technology – layouts, cables, components, Controls. Performance of Electric Vehicles. Traction Motor Characteristics. Tractive effort and Transmission Requirements. Vehicle resistance. Types: Rolling resistance, grading resistance. Aerodynamic drag vehicle performance. Calculation of the rolling resistance and the grade resistance. Calculating the acceleration force. Maximum speed. Finding the total Tractive effort. Torque required on the drive wheel. Transmission: Differential, Clutch and Gear box, Braking performance. Electric Vehicle chassis and body design. Batteries – overview and its types. Battery plug-in and Ultra-capacitor. Charging – Methods and Standards. Vehicle motion and the dynamic equations for the vehicle. Regenerative Braking, Economy, Vibration and Noise reduction. Types and classification of EV. Advantages of EV over fossil-fuel vehicles. Limitations of EV. Impact on environment of EV technology. Disposal of battery, cell and hazardous material and their impact on environment.

EEE 519: Modeling and Computer Simulation (3 Units C: LH 45)

Learning Outcomes

At the end of this course, the students should be able to:

1. Define system modelling;
2. Classify and characterize models;
3. State importance of system modelling;
4. Identify various computer software packages in Electrical and Electronic Engineering; and

5. Build models and apply MATLAB/SIMULINK in solving practical problems in Electrical and Electronic Engineering.

Course Content

Introduction to system modelling. Model formation. System definition. Classification of models. Characteristics of models. Importance of mathematical models. Methodology. Defining and documenting the problem. Analysis of data. Formulation of subsystem models. Simulation/Software tools. Merits and Demerits of Computer software. Integration of subsystems. Running and debugging of programs. Introduction to MATLAB/SIMULINK software. Practical applications to Electrical/Electronic Engineering: Curve fitting, Interpolation, Electrical network, thermal modelling, Transient studies, Stability studies, Bus-Admittance matrix formation and Power forecasting.

GET 511: Engineering Project Management (3 Units C: LH 45)

Learning Outcomes

At the end of the course, students should be able to:

1. Explain the basics of project management as it relates to the Engineering discipline;
2. Demonstrate knowledge and understanding of engineering, management and financial principles and apply these to their own work, as a member and/or leader in a team to manage projects and in multi-disciplinary environments;
3. Conduct, manage and execute projects in multi-disciplinary areas;
4. Possess the skills needed for project management; and
5. Work within the budget when executing a project for proper management.

Course Content

Project management fundamentals – definitions, project environment, nature and characteristics, development practice, management by objectives and the centrality of engineering to projects, infrastructures, national and global development. The scope of project management – organisational, financial, planning and control, personnel management, labour and public relations, wages and salary administration and resource management. Identification of project stakeholders; beneficiaries and impacted persons – functions, roles, responsibilities. Project community relations, communication and change management. Project planning, control and timeliness: decision making, forecasting, scheduling, work breakdown structure (WBS), deliverables and timelines, logical frameworks (log frames), risk analysis, role of subject matter experts (SMEs), role conflicts; Gantt Chart, CPM and PERT. Optimisation, linear programming as an aid to decision making, transport and materials handling. Monitoring and Evaluation – key performance indices (KPIs); methods of economic and technical evaluation. Industrial psychology, ergonomics/human factors and environmental impact considerations in engineering project design and management. Project business case - financial, technical and sustainability considerations. Case studies, site visits and invited industry professional seminars. General principles of management and appraisal techniques. Breakthrough and control management theory; production and maintenance management. Training and manpower development. The manager and policy formulation, objective setting, planning, organising and controlling, motivation and appraisal of results.

GET 512: Engineering Law (2 Units C: LH 30)

Learning Outcomes

Students will be able to:

1. Describe and explain the basic concept, sources and aspects of law;

2. Describe and explain the major differences between the various categories of law, courts and legal jurisdictions;
3. Describe and explain legal principles and their application in professional engineering design and management services and their professional liability implications; and
4. Develop reasoned analysis of real-life or hypothetical engineering scenarios using the legal principles undertake critical analysis of reliable information to develop and practically present technical reports for use in varying judicial/quasi-judicial settings including as an expert witness.

Course Content

Common Law: its history, definition, nature and division. Legislation, codification interpretation. Equity: definition and its main spheres. Law of contracts for Engineers: Forms of contract and criteria for selecting contractors; offer, acceptance, communication termination of contract. Terms of Contracts; suppliers' duties – Damages and other Remedies. Termination/cancellation of contract Liquidation and Penalties; exemption clauses, safety and risk. Health and Safety. Duties of employers towards their employees. Duties imposed on employees. Fire precautions act. Design for safety. General principles of criminal law. Law of torts: definition, classification and liabilities. Patents: requirements, application and infringement. Registered designs: application, requirements, types and infringement. Company law. Labour law and Industrial Law. Business registration.

EEE 520: Sensor and Artificial Neural Networks (2 Units C: LH 30)

Learning Outcomes

At the end of this course, the students should be able to:

1. Discuss the various sensors and actuators used in electrical and electronic systems;
2. Discuss and answer simple questions on the basics of energy transformation using transducers, sensors and actuators;
3. Describe in details the interfacing of sensors with microprocessors in building electronic systems;
4. Calibrate sensor-based electronic systems;
5. Discuss Process control using various controllers;
6. Understand the theories and principles of the PLC; and
7. Understand the software environment and the programming of PLC.

Course Content

Introduction to sensors and actuators in electronics systems: sensing principles for measuring motion, force, torque, pressure, flow and temperature using analogue and digital transducers. Basics of Energy Transformation: Transducers, Sensors and Actuators. Understanding of Sensor Interfacing with Microprocessor to build electronic systems. Static and Dynamic Characteristic Parameters for Sensors and Actuators. Calibration of Sensor-based electronics systems. Sensor performance criteria and selection, including: (a) Thermocouples (b) Resistive sensors (c) Inductive sensors (d) Capacitive sensors (e) Piezoelectric sensors (f) Encoders and tachometers. Process Control: Introduction to Process Control, PID, PID Controller Tuning, PID Controller Implementation Programmable Logic Control: The Software Environment and Programming of PLC, Sequence Control and Structured RLL Programming, Programming of PLCs Sequential Function Chart. Introduction to Artificial Neural Network and applications, Fuzzy Logic.

EEE 521: Electric Power System Analysis, Planning and Protection (2 Units C: LH 30)

Learning Outcomes

At the end of this course, the students should be able to:

1. Develop models of power system components;
2. Carry out load flow studies using different techniques (e.g. Gauss-Seidel, Newton-Raphson etc.);
3. Describe the electrical characteristics of faults and types of faults;
4. Analyze faulty systems;
5. Develop protective schemes against faults; and
6. Show how the power system operates during steady-state conditions and under transients.

Course Content

Principles of power systems protections: Requirements. Current and voltage level protection. Time grading. Principles of simple differential protection schemes. Deregulated Power Systems: Historical Development. Technical issues. Economic issues. Regulatory issues. Challenges in decentralized control of power systems. Optimal power flow tools applied to deregulated electric power industry. Transaction management system (TMS). Congestion management. Nigerian Power Systems and Deregulation. Modelling of power systems Components. Load growth. Load forecasting. Introduction to power systems planning and operation using mathematical programming techniques.

EEE 522: Power Electronics (3 Units C: LH 45)

Learning Outcomes

At the end of this course, the students should be able to:

1. Understand the principles of power control by switching;
2. Demonstrate the benefits of switched mode circuits; be familiarised with the commonly used semiconductor switching devices;
3. Analyze and Demonstrate a full understanding on several DC-DC converters;
4. Apply phasor analysis to explain how the steady-state AC voltage and current are related to each other in power circuits;
5. Classify and derive active, reactive and apparent power;
6. Explain the operation principles for several thyristors-based rectifiers;
7. Describe the H-bridge based inverters and their several control methods; and
8. Apply Multisim or Workbench simulation software in solving Power Electronics problems.

Course Content

The basics of three-phase circuits, connections. Voltage and current analysis. Real and reactive power calculations. The fundamentals of electricity conversion from the form supplied by the source to the forms required by the load. Power electronic conversion techniques, including the basic converters (DC-DC, AC-DC and DC-AC). Power Switching Methods. Power control methods. The methods of circuit analysis applicable to switched mode circuits. Essential properties of the relevant semiconductor devices. Simple converters for practical applications. Characteristics of power devices. DC-DC converters: AC Current, Voltage, Power. AC-DC converters. Inverters (DC-AC converters). Application of Multisim or Electronic Workbench software in Power Electronics.

EEE 523: Power System Modeling and Optimization (2 Units C: LH 30)

Learning Outcomes

At the end of this course, the students should be able to:

1. Identify the various components that make up electric power system;
2. Develop mathematical models of power system components;
3. Explain the different characteristics and functions of these components;
4. Use MATLAB/SIMULINK to model and analyze power system network; and
5. Apply optimization techniques to power system operation and planning.

Course Content

Power system components functions, application and performance. Relative cost. Overall planning problem considering: present worth. Cost benefit principles. System reliability. Load forecasting. Non-linear programming: constrained minimization methods.
Unconstrained minimization methods. LaGrange multipliers. Kuhn – Tucker conditions. Linear Programming. Quadratic Programming. Integer Programming. Applications of optimization techniques to power system: Dispatch. Optimal load shedding. Transmission planning. Application of MATLAB/SIMULINK to power system modelling.

EEE 524: Digital Signal Processing (2 Units C: LH 30)

Learning Outcomes

At the end of this course, the students should be able to:

1. Specify the sampling, quantization and signal conditioning requirements for a given DSP application;
2. Identify components of a DSP hardware system and program a DSP processor in the C language;
3. Estimate spectra of discrete-time signals using the fast Fourier transform (FFT) in MATLAB and implement the FFT on a DSP chip;
4. Determine and interpret the z-domain transfer function of a discrete-time system and design discrete time filters in the z domain using the pole-zero method;
5. Design Finite Impulse Response (FIR) and Infinite Impulse Response (IIR) discrete-time filters for low-pass, high-pass, band-pass, band-stop and arbitrary frequency response applications;
6. Implement digital filter designs in MATLAB and on a DSP chip; and
7. Analyse discrete-time filter banks and multi-rate signal processing systems.

Course Content

Review of discrete-time signals and systems with emphasis on sampling and quantization. Introduction to DSP hardware architecture: including fixed-point. Floating-point processors. The multiply-accumulate unit. The discrete Fourier transform. The fast Fourier transform (FFT). The use of the FFT for convolution analysis. The use of FFT for spectral analysis. Convolution analysis using the discrete-time Fourier transform. Spectral analysis using the discrete-time Fourier transform. Z-transforms. Pole-zero analysis of discrete-time systems. Pole-zero-based digital filter design. Analysis of FIR and IIR discrete-time systems with emphasis on phase response. Design and implementation of FIR digital filters. Design and implementation of IIR digital filters. Introduction to multi-rate signal processing and filter banks.

EEE 525: Hybrid Electric Vehicles (2 Units E: LH 30)

Learning Outcomes

At the end of this course, the students should be able to:

1. Explain the basics of hybrid electric vehicles, their architecture, technologies and fundamentals;
2. Explain plug–in hybrid electric vehicle architecture, design and component sizing and the power electronics devices used in hybrid electric vehicles;
3. Analyse various electric drives suitable for hybrid electric vehicles;
4. Discuss different energy storage technologies used for hybrid electric vehicles and their control; and
5. Interpret hybrid electric vehicle configuration by different techniques, performance analysis and energy management strategies in HEVs.

Course Content

History of HEVs. Classification of HEVs – Micro, Mild, Full, Plug-in. HEV layout. Basic architecture of HEV drive train. State of the art of HEVs. Analysis of series drive train, parallel drive train and series-parallel Hybrid drive train. Vehicle motion and the dynamic equations for the vehicle. Propulsion systems and components of HEVs. Regenerative Braking, Economy, Vibration and Noise reduction. Types of HEV and its controls. Advantages and Disadvantages of HEVs. Comparison of HEVs with Electric Vehicles. Power Electronics in HEVs. Comparison of different Energy storage technologies for HEVs. Battery charging Control. Electric Machines and Drives in HEVs. Overview of Toyota prius.

EEE 526: Electric Motor Drives (2 Units C: LH 30)

Learning Outcomes

At the end of this course, the students should be able to:

1. Describe basic converter/inverter-fed technologies of electric motors;
2. Explain the drive quadrant concepts and motor operating cycles;
3. Simulate and analyze the dynamic models of motor drive systems;
4. Discuss fundamental issues on electric vehicles and its applications; and
5. Apply MATLAB/SIMULINK in the modeling of Electric motor drives.

Course Content

Introduction to electric drives. Types of drives. Merits and demerits of Electric drives. Common types of motors used in electric drives. Load types. Speed/torque characteristics. Essential converter circuits, Inverter/converter-fed machines, Hybrid drive trains, traction and propulsion systems, Electric vehicles and flywheel applications, D-Q axis analysis of controlled induction motor, dynamic analysis of controlled motors. DC motor drives (Analysis and control). Synchronous motor drives. Motor drive quadrants and its operating characteristics. Motor operating quadrants and applications of motor drives. Selection of appropriate motors for electric drives. Factors of motor selection – electrical, mechanical, size, rating and cost. Motor characteristics and applications. Heating and thermal characteristics of motors. Drives for specific applications: Textile mills, steel rolling mills, cranes and hoist drives, machine tools, cement mills, etc. Application of MATLAB/SIMULINK in Electric motor drives.

EEE 527: Power Systems Communication and Control (2 Units E: LH 30)

Learning Outcomes

At the end of this course, the students should be able to:

1. Describe substation major equipment and how reliable telecommunications affect their operations;
2. Explain power line communication and wireless technology principles;
3. Explain the purpose of system control and the different levels of control – generation control, transmission control;
4. Describe control parameters and methods of control – excitation system control, governor control, power control, frequency control, voltage control, reactive power control;
5. Model and analyze control devices – static var compensators, synchronous condensers, switched capacitors and reactors, automatic voltage regulators, regulating transformers, Flexible AC Transmission Systems (FACTS), Static Synchronous Compensator (STATCOM), DC – AC converters and their optimal location within the power system.

Course Content

Review of transmission line theory. High frequency communication on power lines. Carrier systems and power line carrier applications. Multiplexing, Telemetering, Signal processing and Data transmission. Control of power generation, voltage control using FACTS devices, system stability, and automatic voltage regulators, regulating transformers.

EEE 528: Mobile and Wireless Systems (2 Units E: LH 30)

Learning Outcomes

At the end of this course, the students should be able to:

1. Have a clear and concise understanding of communication techniques and protocols used in Cellular networks, Long term evolution (LTE), 4G/5G mobile systems, Mobile Peer to Peer (MP2P) network, Wireless Sensor Network (WSN) and Mobile Ad Hoc Network (MANET) and Vehicular Ad Hoc Network (VANET);
2. Distinguish and adequately explain principal concepts underpinning the development of broadband mobile and wireless systems, as well as assess application-specific scenarios and thereby identify any issues or related problems and their respective solutions;
3. Analyze and demonstrate fundamental network performance measures and have a clear and defined realization of end-to-end wireless network evaluation concepts;
4. Determine and demonstrate various design issues in mobile and wireless systems, for seamless and reliable communication considering fundamental concepts such as Radio Coverage, Capacity, Bit and Frame-Error Rate;
5. Successfully evaluate communication protocols under different realistic performance and environmental scenarios, including hands-on experience with discrete-event frameworks such as Network Simulator (ns3);
6. Develop advanced knowledge and analyze techniques on how to monitor network threads/processes, as well as identify inter-operational characteristics in a wireless network system; and
7. Survey and research on state-of-the-art areas of high performance mobile and wireless systems.

Course Content

Introduction and applications of Mobile and Wireless Networks. Overview of Wireless Network Topologies (Infrastructure/Infrastructure-less, Stationary/Mobile), their layered architectures, current and emerging technologies. Fundamentals of mobile and wireless network communications in the presence of a noisy channel, multiple access techniques. Wireless Radio Resource management (RRM), rate adaptation, handover, power allocation and

control. Mobility models for Wireless Networks and their effects on end-to-end communication. Fundamentals of modern Cellular Networks and their architectures. Routing protocols for Wireless Networks and solutions to obstacles induced by mobility. Performance analysis of remotely hosted communications, metric interpretation, Quality of Service (QoS) metrics and techniques based on requirements of delay sensitive wireless Internet applications. Efficient management of network resources through Power and Energy adaptation. Capacity Analysis and Evaluation, comparison of analytical models with simulations. Performance evaluation schemes for network monitoring and efficient resource management. State-of-the-art survey of the related bibliography on Wireless and Mobile systems.

EEE 529: Solid State Electronics (2 Units C: LH 30)

Learning Outcomes

At the end of this course, the students should be able to:

1. Describe finite state machine and its applications in designing digital circuits;
2. Build advanced digital logic circuits by applying various reduction techniques and schemes;
3. Operate, debug, simulate and analyse complex digital designs in modern VHDL software;
4. Analyse and synthesise digital circuits using commercially available VHDL software;
5. Create FPGA designs and implement state-of-the-art ASIC/FPGA design methodologies for computer-aided design of logic circuits; and
6. Demonstrate practical skills in designing, synthesising and simulating digital systems.

Course Content

Finite State Machine (FSM): 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 and Complex Programmable Logic Device (CPLD) architectures. VHDL design: top-down design flow, verification, simulation alternatives, simulation speed, formal verification, recommendations for verification, writing Register Transfer Language (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.

ELE 521: Embedded Systems Design and Programming (2 Units E: LH 30)

Learning Outcomes

On the completion of the course, students will be able to:

1. Analyse and explain the basic building blocks of embedded systems hardware;
2. Identify relevant components and building blocks for embedded solutions;
3. Evaluate different embedded system architectures;

4. Describe the hardware and software architecture of processors used in embedded systems;
5. Use embedded system development platforms and environments;
6. Specify relevant embedded systems requirements such as memory, processor speed and energy consumption;
7. Develop experience in assembler and C programming languages; and
8. Build embedded system solutions with the help of common hardware interface units.

Course Content

Introduction to microcomputers and embedded systems: Processor architectures, Microcontrollers used in embedded systems; CPU, memory and input output units; Interrupts; Introduction to hardware level programming of embedded systems: Programming in assembler, Programming in C, Development platforms for embedded software; Introduction to microcomputer interfaces: Digital I/O, Serial I/O, Timers, Analog- to-digital conversion, Pulse Width Modulation (PWM).

TEL 528: Energy Economy (2 Units E: LH 30)

Learning Outcomes

At the end of the course, the students should be able to:

1. Demonstrate knowledge of the Nigerian and the world energy situation;
2. Understand the economic fundamentals of energy demand and supply;
3. Understand the economic fundamentals underpinning energy types;
4. Be familiar with the important theoretical work that underpins the study of energy
5. economics; and
6. Appreciate the important energy policy issues.

Course Content

This course explores the theoretical and empirical perspectives on individual and industrial demand for energy, energy supply, energy markets and public policies affecting energy markets. It discusses aspects of the oil, natural gas, electricity and nuclear power sectors and examines energy tax, price regulation, deregulation, energy efficiency and policies for controlling emission.

GET 521: Engineering Management (3 Units C: LH 45)

Learning Outcomes

Upon completing this course, students will be able to:

1. Develop leadership and team working skills for evaluating and optimizing processes, improving efficiency and managing supply chains within engineering organizations;
2. Foster innovation, manage new technologies and integrate sustainability principles in an engineering environment; and
3. Gain proficiency in identifying, assessing and mitigating risks associated with engineering projects and manage change effectively within engineering organizations.

Course Content

Essence of management task. Patterns of leadership. Creating a viable organization. Productivity and motivation, organizing task. The span of control and the delegation of authority. Organizational theory and concepts. Industrial safety. Industrial relations.

Technology innovation and sustainability: Change, Risk, Logistic and Supply Chain management. Application of industrial engineering tools to solve health care delivery problems

focused on cost reduction and quality improvement by facility and process redesign and systems integration. Operational specialties integration in a project consulting firm. Group technology tasks involve designing, planning and implementing an engineering project to stimulate students' multidisciplinary teams' working ability or application of industrial engineering tools in evaluating and solving any practical organizational problem.

EEE 599: Final Year Project (6 Units C: PH 270)

Learning Outcomes

The student(s) will develop a technology and/or system to solve a known and significant electronic engineering problem and design, and if possible/practicable, build/produce/ manufacture some relevant new hardware/device(s) representing the solution using the skills acquired in the programme.

Course Content

Individual student or group of students' projects undertaken to deepen knowledge, strengthen practical experience and encourage creativity, entrepreneurship and independent/team work (as may be the case). The project ends in a comprehensive written report of a developed system and/or product/service and oral presentation/defense before a panel of assessors, one of whom must be external to the University awarding the Electrical and Electronic Engineering Degree.

SECTION 7
STAFF

The academic staff of the department are listed in Table 8.1, while the technical staff are listed in Table 8.2. The department also has administrative staff, and they are presented in Table 8.3.

Table 8.1: List of Full Time Departmental Academic Staff

S/N	Name of Staff	Rank	Specialization
1.	Engr. Prof. O. I. Okoro	Professor	Electrical Machines
2.	Engr. Prof. L. I. Oborkhale	Professor	Communication Engineering
3.	Engr. Prof. P. I. Obi	Professor	Electrical Power
4.	Engr. Prof. A. J. Onah	Professor	Power Electronics
5.	Engr. Prof. M. N. Nwohu	Professor	Power Systems
6.	Engr. Dr. E. U. Udo.	Associate Professor	Electronics
7.	Engr. Dr. I. K. Onwuka	Associate Professor	Electrical Power Devices
8.	Engr. Dr. C. C. Awah	Associate Professor	Electrical Machines
9.	Engr. Dr. C. K. Okoro	Senior Lecturer	Control of Drives
10.	Engr. Dr. G. C. Diyoke	Senior Lecturer	Power Electronics and New Energy Systems
11.	Engr. Dr. C. N. Akwuruoha	Senior Lecturer	Telecommunication
12.	Engr. Dr. C. A. Okeke	Senior Lecturer	Communication and Control Engineering
13.	Engr. Dr. O. Oputa	Senior Lecturer	Power System Engineering
14.	Engr. Dr. A. O. Ekwe	Senior Lecturer	Communication Engineering
15.	Engr. Dr. C. Iroegbu	Senior Lecturer	Communication Engineering
16.	Engr. Dr. E. C. Abunike	Senior Lecturer	Machines and Drives
17.	Engr. Dr. K. N. Ukoima	Lecturer I	Electrical Power and Machines
18.	Engr. O. A. Nwaorgu	Lecturer I	Communication Engineering
19.	Engr. Y. Omosun	Lecturer I	Communication Engineering
20.	Engr. N. V. Irokwe	Lecturer I	Electrical Machines
21.	Engr. Dr. C. C. Enebe,	Lecturer I	Electronics
22.	Engr. A. E. Amako	Lecturer II	Power Systems

Table 8.2: List of Full Time Technical Staff

S/N	Name	Rank
1.	Engr. Richard Ubadire Obasi	Chief Technologist
2.	Dr. Ebenezer Adeniyi Ajayi	Chief Technologist
3.	Engr. Ifeanyi Kenneth Nwaji	Principal Technologist I
4.	Engr. Ayodele Anthony Olatunji	Principal Technologist I
5.	Mr. Raphael Okere	Principal Technologist II
6.	Engr. Ogbonnaya Obasi	Principal Technologist II
7.	Engr. Jeffery Obulor Matthew	Principal Engineer
8.	Engr. Nwachukwu, James	Principal Technologist II
9.	Engr. Kingsley Onyeka Odo	Principal Engineer
10.	Engr. Okezie Ikwunagu	Assistant Chief Technical Officer
11.	Mr. Ogbonnaya Idam	Technologist I
12.	Mr. Joshua Nebo	Principal Technical Officer

Table 8.3 List of Administrative Staff

S/N	Name	Rank
1.	Mr. Philip Onozie Ekpemiro	Assistant Registrar
2.	Mrs. Ngozi Endurance Mbaonu	Principal Confidential Secretary I
3.	Obodoeche Nnenna	Assistant Chief Executive Officer
4.	Mrs. Ofoegbu Ngozi Esther	Senior Executive Officer
5.	Mrs. Eucharia Ifeoma Onyeleonu	Caretaker