KHALIFA ISYAKU RABIU UNIVERSITY, KANO-NIGERIA (KHAIRUN)

Faculty of Engineering

STUDENT HANDBOOK

September 2024

STUDENT'S PERSONAL INFORMATION

Name: _____

Date of Birth: _____

Faculty: _____

Department: _____

Programme: _____

Level _____

State of Origin _____

Nationality _____

GSM NO. _____

NOTE

BRIEF HISTORY OF THE FOUNDER

SHEIKH KHALIFA ISYAKU RABIU
KADIMUL QUR'AN

Khalifa Sheikh Isyaku Rabiu was born in the ancient city of Kano, in the year 1928 at Jingau quarters. His Parents were Sheikh Muhammad Rabiu and Hajiya Fadimatu. May their souls rest in Jannatul Firdaus.

Khalifa started studying the **recitation of the Holy Qur'an** under the guidance of his father from 1936 to 1942 when he had the traditional ceremony of completing the reading and learning of the Holy Qur'an. Khalifa Sheikh

Isyaku Rabiu proceeded further with his studies in Borno State (Maiduguri) where he completed the **memorization and recitation of the Holy Qur'an** in 1946.

Khalifa continued with the study of **Tasawwuf and Dariqa** under Sheikh Abubakar Mijinyawa at Bakin Ruwa Quarters, Kano. He later returned back to his father's school where he received the knowledge of **Quranic science recitation (Tajwid).** However, Khalifa Sheikh Isiyaku Rabiu subsequently transferred to Sheikh Abdullahi Salga's school at Sanka in the city of Kano, for him to study **Islamic Law, Hadith and Jurisprudence** where he graduated in 1949.

After graduation from Sheikh Abdullahi Salga's school his father gave him permission to start a business, where he started **trading in Kurmi Market** in 1949. In February 1952 Khalifa registered his business as a company called **Isiyaku Rabiu and Sons Limited**.

As time went on in 1973, Khalifa changed the company name to **Isiyaku Rabiu Group Of Companies** a conglomerate of twelve companies dealing in Trading, Manufacturing, Insurance, Banking, Aviation and Real Estate with over 1000 employees. Khalifa Sheikh Isiyaku Rabiu was the **Chairman and Chief Executive officer** of Isiyaku Rabiu & Sons Ltd, Kano Vehicle and Accessories Ltd, Bagauda Textile Mills Ltd, Rabiu Bottling Company

Ltd, Kano Suit and Packing Cases Factory Ltd, IRS Rice Mills Limited, IRS Airlines Limited, Afro Sacks Nigeria Limited, Kano Sugar Industries Limited and Combined Services Nigeria Limited.

In 1969 Khalifa and some other Businessmen in Kano established the First indigenous trading company, **Kano Merchants Trading Company** which later switched to **Bagauda Textile Mills Ltd.** He also played active role in the establishment of companies like, Nigerian Victory Assurance Company, Stanbic Merchant Bank Nigeria (first Chairman), Habib Nigeria Bank Limited, Giwarite Nigeria Limited and Combined Services Nigeria Limited.

Khalifa Sheikh Isiyaku Rabiu was a **Director in many other companies** across the nation and other countries and was also a **Member, Governing Council** of University Of Ibadan, Islamic University of Niger, Niamey, International University of Africa, Khartoum Sudan, Senate Member, Faisal University, Njamena, Chad, Member, Organisation of Islamic Conference Saudi Arabia, Member, Muslim world league, Saudi Arabia. And also a member of its committee on Mosques, Member Council of Ulama, Nigeria.

Sheikh Isiyaku Rabiu was appointed as **leader of the Tijjaniyya Movement** in Nigeria and the neighboring countries in 1994, and also gained the title of **'KHALIFA'**.

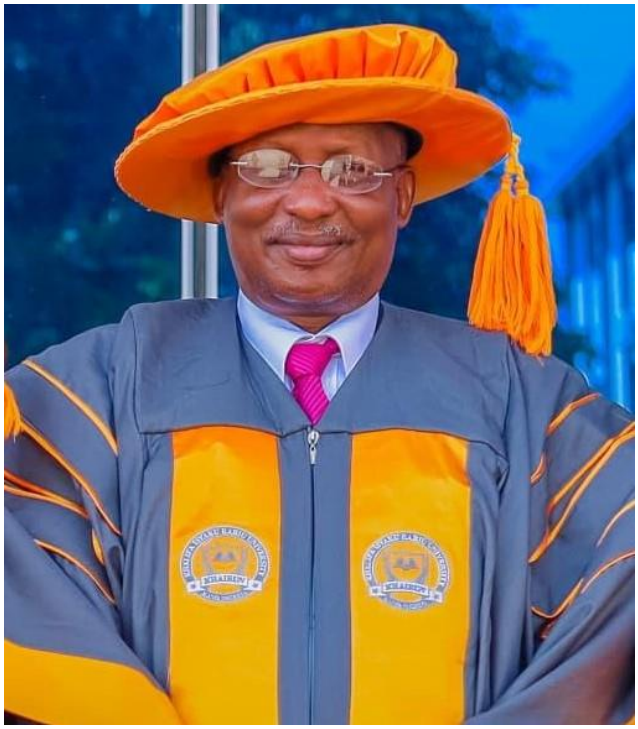
He was the **President of Sheikh Muhammadu Rabiu Islamic Foundation International**, an Islamic organization for both humanitarian and Islamic propagation.

Khalifa received **Award of Men of Achievement** in 1991 by the Cooperate Press Services Ltd, Lagos and Kano State Government Sports Award, the Industrial Giants Merit Award in 1998, Ahmadu Bello International Award In 1999 and also honoured with the **Order of the Federal Republic (OFR)** during the government of president Olusegun Obasanjo, in recognition of his contributions in uplifting the standard of living in his community and the nation at large. And so many other awards.

He is just the one single person in history of Kano, and the Northern Nigeria in Nigeria that has succeeded in the establishment of Private schools from kindergarten to university level. May his gentle soul continue to rest in Jannatul Firdaus.

TABLE OF CONTENTS

Vice-Chancellor's Welcome Message



Abdulrashid Garba, *PhD; fcasson; mnae, icasson*
Vice-Chancellor

In the year 2022, the National Universities Commission (NUC) announced an addition of a new private university in Kano State. That was the proclamation of the Khalifa Isyaku Rabiu University, Kano. The University's acronym is KHAIRUN. The Founder of the University, was Khalifa Isyaku Rabi'u (Khadimul Qur'an), *rahimahulLah*. Until his *wafat* he demonstrated keen interest and desire to witness the completion

of his long standing ambition of building an educational empire, from Kindergarten to the University level. Allah (SWT) in His infinite mercies did not plan for that. In His divine wisdom, Allah SWT has however, blessed the worthwhile ambition of this gentleman - today, KHAIRUN is a reality. It is an addition to the various schools he has established from the scratch. May Allah SWT continue to rest his gentle soul in Jannat el-Firdaus.

Presently, KHAIRUN has three Faculties, ten Departments and sixteen academic programmes, namely: Allied Medical Sciences with three Departments and three programmes; Science and Computing with five Departments and ten programmes; and Engineering with two Departments and three programmes. Each of these programmes has been equipped with state of the art equipment in classes and in the laboratories. In addition to all these there are smart classrooms for easy tutelage, strong internet access, and a vibrant website. The University Library is well equipped with current holdings and e-resources. There is also a well-equipped hostel facility for both male and female, and for international students. All these are provided for students in order to ease academic pursuit.

While we remain prayerful for Allah's protection, the University has provided adequate security measures to protect lives and properties, and against any incursion by insurgent elements. To crown all these, the University has a well-planned arrangements on ground to ensure strict compliance to all University regulations, social norms and values, and for the observance and enforcement of our highly cherished Islamic traditions. Staff and students are therefore encouraged to be wary of, to support and be ready to imbibe the peculiarities of KHAIRUN environment.

I want to, on behalf of Proprietors, Board of Trustees, Governing Council and Management of KHAIRUN, welcome all the newly admitted students to this promising citadel of learning. I also wish to congratulate you for the single advantage and rare privilege of being pioneer students.

Abdulrashid Garba, *PhD; fcasson; mnae, icasson*
Vice-Chancellor

The University Logo

The Logo is circle in shape containing a book and a pen embossed on brown strip.

The book and pen depicts hallmark of knowledge. The brown colour represents soil from which life began; on to which the resources for sustaining life on earth exist; and into which life shall end. This signify that the University emphasizes knowledge and its translation into real life applications guided by code of ethics that leads to good ending. The writing printed in the Logo's upper semicircle is the name of the **Founder** of the University:

Khalifa Isyaku Rabiu

This represents an exemplary life of commitment, dedications, hardwork and sacrifice in the service to humanity, worthy of emulation by students and staff of the University

Motto

"Functional Education is Light"

The University is dedicated at producing total person with the requisite skills, knowledge and values relevant to the 21st century.

The University Colours

The **Orange,** as a blend of red and yellow is associated with energy and happiness that boosts aspirations, stimulates mental activity and enhances confidence and understanding. Thus, the University emphasize to stimulate its students to attain utmost capabilities in their educational pursuits.

The **Ash** characterizes transparency which portrays the uniqueness of the colour. It is sometimes equated with grey and can be used for font colour, headers, graphics, and even products to appeal to mass audience. KHAIRUN's stunning façade is decorated in soft ash and its variations.

Vision

The vision of the University is to be a World-Class teaching and research University, producing educated, self-discipline, confident and independent minded graduates (Character and Learning)**.**

Mission

The mission of the University is to produce educated, morally sound and skilled graduates that will respond to the Challenges of 21st century

Philosophy Goals and Objectives

The University will embrace openness in the pursuit of knowledge and will welcome intellectually restless students, who use their talents to put ideas to test. Education in the University will not be viewed only as a gateway to personal development but also as a pathway to improve society. The University will strive to help students develop knowledge,

appreciation, understanding, ability and skills which will prepare them for responsible living in a complex World

The university has a faith-based philosophy presupposes the integration of faith and learning. The university is prepared to invest the time necessary to prepare students intellectually and spiritually to be productive citizens in the 21st century. The students will be assisted to reach their highest potentials.

Goals and Objectives

a) Encourage the advancement of learning and to hold out all persons without distinction of race, creed, sex or political conviction the opportunity of acquiring a higher and liberal education;
b) Provide resources for instruction and other facilities for the pursuit of learning in all its branches, and to make those facilities available on proper terms to such persons as are equipped to benefit from them;
c) Encourage and promote scholarship and conduct research in all fields of learning and human endeavor;
d) Evolve academic programmes to suit the changing social and economic needs of the society through continuous review of curricular and development of new programmes through programme structural flexibility to respond to societal technological changes;
e) Create and expand access and opportunities for education, attract and retain quality students, researchers, teachers, and other academic and non-academic staff thereby assisting in developing human capital development and mitigation of the brain drain currently afflicting Nigeria;
f) Produce internationally acceptable graduates that would compete favorably with their peers anywhere in the World;

g) Cary out basic and applied research leading to the domestication and application of new technology to the Nigeria context through collaborative linkages with other academic and research institutions in Africa and the rest of the world;
h) Establish a center for entrepreneurial studies to stimulate job creation and innovative capacity in students from onset of their studies, in such a way that graduates shall be resourceful, self-reliant and job creators; and
i) Undertake other activities appropriate for teaching and community service as expected of a University of high standard.

Academic and Official Costume

The official costume for academic ceremonies will be in line with university academic colours (Ash, Dark Ash and Light Ash). In addition, each faculty has its own colour to differentiate it from other faculties. The Faculty of Engineering colour is *Gold*.

Faculty	**Colour**	**Meaning**
Faculty of Engineering (FENG)	Gold	Quality, integrity and resilience

Authorities of the University

The University Authority are the Proprietors, Officers of the Board of Trustees, the Council, the Senate, Faculty Board, the Congregation and Convocation.

Proprietor
The proprietor of KHAIRUN is the Muhammad Rabiu Islamic Foundation International that is responsible for the appointment of Board of Trustees.

Board of Trustees
Board of Trustees is the highest governing body of the University charged with the overall policy direction and financing of the University.

Council
Council is another governing body appointed by Board of Trustees which is charged with the general management of the affairs of the University, and in particular, the control of the property and expenditure of the University. The membership of the Council consists of the Pro-Chancellor, Vice-Chancellor and representatives of the senate, congregation, convocation NUC, interest groups, Kano State government, proprietor's nominee and the Registrar.

Senate
The Senate is responsible for the organization and control of admission, teaching, and discipline of students and promotion of research at the University. The membership of the senate consist of the Vice-Chancellor, University Librarian, Dean of faculties, including Dean, Student Affairs, Directors of academic centers, Heads of academic departments, Director academic planning, all Professors of the University, one elected from each faculty not below the rank of senior lecturer, and the registrar who shall be the secretary.

Faculty and Departmental Administration
Faculties shall be the center of teaching and research. It is directly responsible for the control of teaching, examination and evaluation of students. Each faculty should have faculty board while a department shall have departmental board. The Dean and Head of department shall handle the administration of the faculty and the department respectively.

Congregation
The congregation provides an opportunity for members to meet and express their views on all matters affecting the interest and welfare of the University and its members. Members consist of all academic staff and non-academic staff holding degree conferred by recognized universities or any other qualifications recognized by the University.

Convocation
The convocation shall have the functions of awarding certificate, diplomas and degree, both undergraduate and post graduate of the University. Members consist of Pro-Chancellor and Chairman of Council, Vice-Chancellor, University Librarian, Bursar, Registrar, all full time academic staff, and graduate of the University.

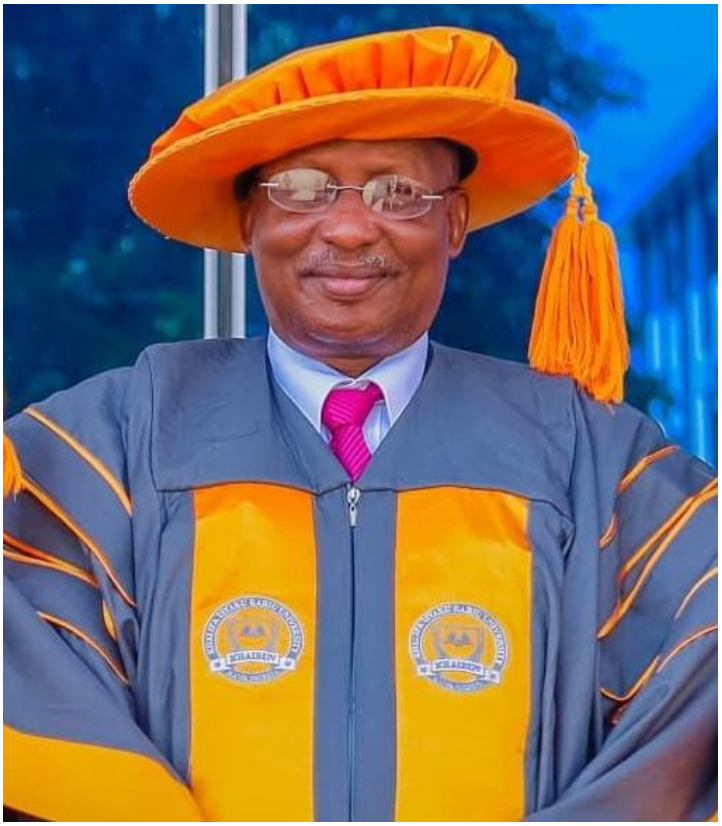
Chancellor and Principal Officers of the University

CHANCELLOR

Alhaji Samaila Mohammed Mera (CON)

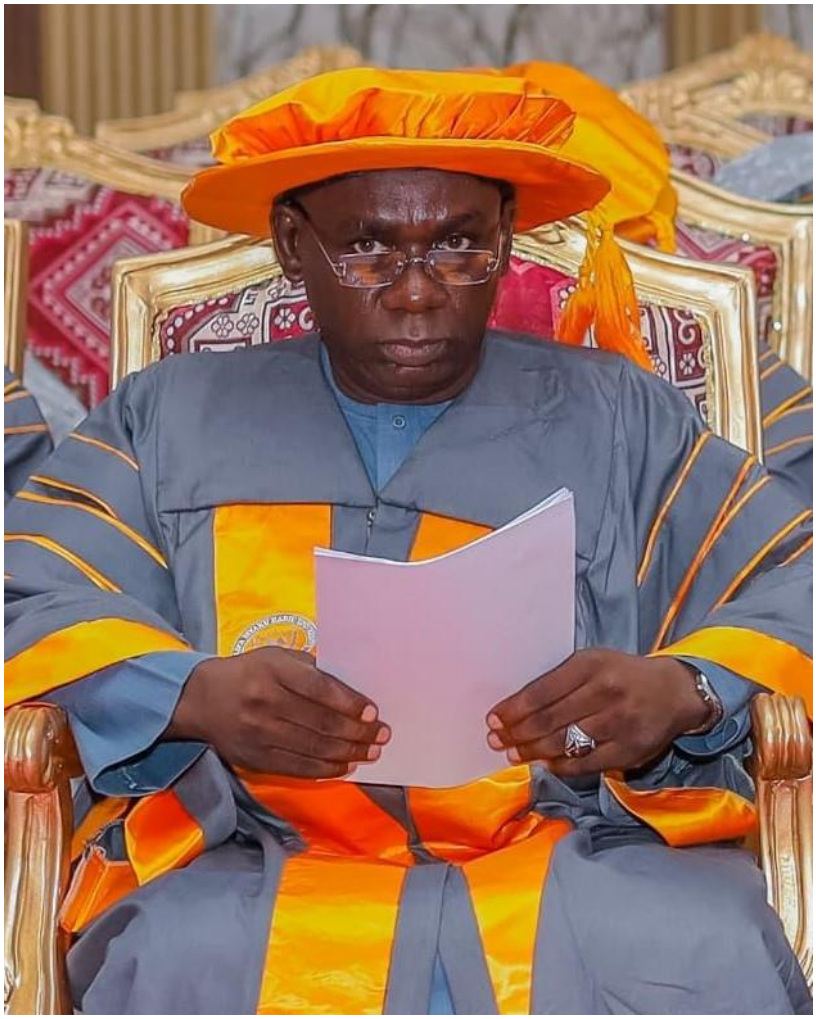
Emir of Argungu

PRO-CHANCELLOR
Prof. Kabiru Isyaku OON, FNAE, mni



VICE-CHANCELLOR

Prof. Abdulrashid Garba, *PhD; fcasson; mnae, icasson*



REGISTERAR
Malam Yusuf Datti

BURSAR
Dr. Najaatu Bala Rabiu CNA, ACTI,

UNIVERSITY LIBRARIAN
Nazir Muhammad, CLN, MNLA

1.0 ORGANIZATION OF THE ADMINISTRATION

The organization of the administration: The University Central Administration is made up of Vice-Chancellor`s Office, the Registry Department and Bursary Department.

1.1 **The Vice-Chancellor`s Office** This is headed by the Vice-Chancellor.

1.2 **The Student Development Division:** The division, headed by the Dean, who is under the Vice-Chancellor`s Office. It is responsible for the administration of non-academic affairs of student in the university;

1.3 **Information, Publication and Marketing:** This is headed by a Principal Assistant Registrar and is responsible for the public relation matters, publication and marketing for the University.

1.4 **Directorate of Academic Planning**: This is headed by a Director and is responsible for various statistics and accreditation matters of the university;

1.5 **Security Division:** This is headed by a Director and deals with the security of lives and properties of the university community;

1.6 **Registry Department:** The registry is headed by the Registrar, who is chief administrator of the university and is responsible to the Vice-Chancellor for all the administrative matters of the university; and

1.7 **The Bursary Department:** the Bursary is responsible for the administration of all financial matters in the university. It is headed by the Bursar and has among other sections, a student section, which handles student Account (fees and charges paid by students).

1.8 **Quality Assurance Unit QAU**

The primary function of **Quality Assurance unit** is to improve the service delivery and capacity of the available resources of the university ie. The capacity of human and material resources (facilities) of the University. The Unit of the University is headed by the Head, QAU and assisted by the following:

1. KHAIRUN QAU Committee;
2. Complaint Desk Officer;

The Functions of Unit

The Function of the QAU includes:

1. Production, monitoring the performance and review of the QAU within the university;

2. Managing the University complainant relation policy, including providing opportunities for complainant feedback on their services;

3. Institute a complaints procedure, including grievance and redness mechanism;

4. Ensure the improvement of service delivery of the university through QAU compliance;

5. Investigate reason for poor/excellent service delivery in the University;

6. Contributing business improvement plans of the University;

7. Ensure the periodic review of QAU activities.

8. The ability to analyze all complaints and report issues to management relevant to addressing the causes of service failure;

9. Advocacy and change management skills to ensure other officers and management to resolve justified complaints and address the causes of the complaints to ensure improve service delivery over time;

10. To investigate and analyse complaints to ascertain and differentiate the complaints about service delivery; and

11. To keep record of all complaints, comments compliment and suggestions by the staff and students.

DEAN - FACULTY OF ENGINEERING

Prof. Ado Dan-Isa

B.Eng. (BUK), MSc, DPhil. (Sussex), FNCS, RE (COREN), MNSE

Acting Dean,

Faculty of Engineering, KHAIRUN.

DEAN'S WELCOME MESSAGE

Welcome to the Faculty of Engineering, Khalifa Isyaku Rabiu University (KHAIRUN), Kano, Nigeria. It is a young Faculty, vigorous and enthusiastic. Currently the Faculty has a total of three programmes: Computer Engineering, Electrical Engineering and Mechatronics Engineering. All the programmes commenced during the 2023/2024 academic session. The attractive things about our Faculty are the availability of well-equipped laboratories, modern curriculum, learning and teaching facilities. The Faculty is located at the Main Campus of KHAIRUN in Kano, overlooking the historic Gadon Qaya city gate. It is situated close to four other tertiary institutions. The environment is therefore, very conducive academically. The Faculty of Engineering welcomes you.

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Prof. Ado Dan-Isa
Acting Dean, Faculty of Engineering, KHAIRUN.

FACULTY OF ENGINEERING

The Faculty of Engineering is among the take-off faculties with Professor Ado Dan-Isa as the pioneer Dean. The Faculty which started in the 2022/2023 session has two Departments and three programmes to run.

List of Programmes and Degrees

The Faculty of Engineering at KHAIRUN offers bachelor of Engineering degrees in the fields listed in Table 1.

Table 1: List of Programmes and Degrees

SN	Programme	Degree in View
1.	Computer Engineering	Bachelor of Engineering (B.Eng.)
2.	Electrical Engineering	Bachelor of Engineering (B.Eng.)
3.	Mechatronics Engineering	Bachelor of Engineering (B.Eng.)

The above programmes are designed, in general, to be broad-based to equip the graduates with the diverse tools of the profession. However, where it is considered absolutely essential to reflect the various areas of specialization in a programme, such area can be indicated appropriately in the degree title.

Duration

The normal duration of the Bachelor of Engineering (B.Eng.) programme is five years (ten semesters). A candidate who failed to pass the minimum credits required to graduate within the

normal duration can spill-over up to a maximum of 2 years to enable him/her pass the required credits.

Philosophy

The aim of the engineering programmes is to produce engineers with high academic and ethical standards who can identify, interpret, analyse and innovatively create solutions of challenges in engineering and technologies needed by the society. Produce productive graduates that can depend on themselves by creating jobs. The graduates would have adequate and relevant practical exposure to engage in employment in public and private sectors.

Objectives

The general goal and objectives of Engineering and Technology education and training should be in consonance with the realisation of the national needs and aspirations vis-à-vis industrial development and technological emancipation. The graduates must therefore be knowledgeable, creative, resourceful and able to perform the following functions:

1. Application of the knowledge of mathematics, basic and engineering sciences, and proficiency in using standards, codes, and modern information and communication technology tools in engineering practice.
2. Design engineering projects and supervise their implementation.
3. Design and implement components, machines, equipment and engineering systems.
4. Design and develop new products and production techniques in industries.

5. Conceptualise, implement and maintain complex engineering systems for optimal performance in our environment.
6. Adapt and adopt exogenous technology in order to solve local engineering problems.
7. Ability to consider ethics, the environment and sustainability in the solutions to complex engineering problems.
8. Exercise original thought, have good professional judgment and be able to take responsibility for the execution of important tasks;
9. Improve on indigenous technology for deployment to the solution of engineering problems; and,
10. Demonstration of emotional stability, and endowment with critical multidisciplinary and team-work, goal-getting and life survival capabilities and skills, necessary in managing people, funds, materials, equipment and technologies.

Admission Requirements

Candidates are admitted into the degree programme in any of the following two ways:

1. Unified Tertiary Matriculation Examination (UTME) Mode (5-Year Degree Programme).
2. Direct Entry (DE) Mode (4 Year Degree Programme).
3. Inter-University Transfer

Unified Tertiary Matriculation Examination (UTME)

For the five-year degree propgramme, in addition to the acceptable passes in the Unified Tertiary Matriculation Examination (UTME), the minimum admission requirement is credit level passes in Senior School Certificate Examination

(SSCE) in at least five subjects, which must include English Language, Mathematics, Physics, Chemistry and other acceptable science subjects at not more than two sittings.

Direct Entry (DE)

For four-year Direct Entry, in addition to five (5) Senior School Certificate (SSC) credit passes which must include English Language, Mathematics, Physics and Chemistry, candidates with at least two passes in relevant subjects (Mathematics, Physics and Chemistry) at the GCE Advanced Level or IJMB or JUPEB may be considered for admission. Candidates who have good National Diploma (ND) result in relevant Engineering Technology programmes may also be considered for admission into 200 Level. Holders of upper credit pass and above at Higher National Diploma (HND) level, are eligible for consideration for admission into 300 Level. Holders of NCE (Technical) certificates are also eligible for direct entry to 200 Level provided the O'Level and JAMB requirements are satisfied and the NCE is at least a merit.

Inter-University Transfer

Students can transfer from other recognized university into the programme provided they have the relevant qualifications. The University is to satisfy itself that the grades obtained by such candidates are acceptable.

Summary of Mode of Entrance

Table 2: Mode of Entry

SN	Mode of Entrance	Potential Level	Duration			
			Minimum		Maximum	
			Year	Semester	Year	Semester
1	**UTME**	**100**	5	10	7	14
2	**DE**	**200**	4	8	6	12
3	**Transfer**	–	Depend on Year of Entry			

Graduation Requirements

The following regulations shall govern the conditions for the award of an honours degree in Engineering:

1. Candidates must pass all the programme's core courses and such elective/optional courses as may be specified by the Department or the Faculty or the University as the case may be. A candidate who passed all the core courses would obtained the Minimum Credits Required (MCR) for graduation. According to the NUC's CCMAS the MCR should be within the range 150 to 180 credits units (for UTME-based entry, see Table 2). The MCR may change from programme to programme and from time to time due to curriculum review and extant University policies.
2. Candidates admitted through the Direct Entry shall have MCR which is less by the total number of core credit units at Level 100. Such candidates shall have spent a minimum of eight academic semesters or a maximum of twelve semesters in the programme.
3. Obtained a Cumulative Grade Point Average (CGPA) of 1.00 or higher.

4. A student shall also have earned the 15 credit units of Students Industrial Work Experience Scheme (SIWES), 8 credit units of University General Study courses and 4 credit units of Entrepreneurship courses.

For the purpose of calculating a student's Cumulative Grade Point Average (CGPA) in order to determine the class of Degree to be awarded, grades obtained in ALL the courses registered, whether compulsory or optional and whether passed or failed must be included in the computation. Even when a student repeats the same course once or more before passing it or substitutes another course for a failed optional course, grades scored at each and all attempts shall be included in the computation of the CGPA.

Prerequisite courses must be taken and passed before a particular course at a higher level can be registered. Furthermore, if a student fails to graduate at the end of normal academic session, he or she would not be allowed to exceed a total of 14 semesters in the case of students admitted through UTME and 12 semesters in the case of Direct Entry students.

Course System

All the Engineering are run on a modularised system, commonly referred to as Course Unit System. All courses are therefore sub-divided into more or less self-sufficient and logically consistent packages that are taught within a semester and examined at the end of that particular semester. Credits are weights attached to a course. One credit is equivalent to one hour per week per semester of 15 weeks of lectures or three hours of laboratory/studio/workshop work per week per

semester of 15 weeks.

Definition of Course System

This means a quantitative system of organization of the curriculum in which subject areas are broken down into unit courses which are examinable and for which students earn credit(s) if they passed them. The courses are arranged in levels of academic progress. There shall be five levels of courses numbered 101-199, 201-299, 301-399, 401-499 and 501-599. For ease of identification, course numbers can be prefixed by a three-character programme/subject code. Thus, the course code is in the form: DEP LNJ (where the three-letter code DEP identifies the programme, 'L' in LNJ represents the level of the course (1 or 2 or 3 or 4 or 5 for all undergraduate courses), N represents the sub-subject area while J represent the semester the course is offered some hierarchical code. Thus, for example, MEE 207 is a 200-Level course with number 0 say for labs and 7 indicating 1st semester, offered in the mechanical engineering programme. The glossary of all the course codes are presented under Glossary of Codes.

The second aspect of the system is that courses are assigned weights allied to Units.

Units: Consist of specified number of student-teacher contact hours per week and per semester. Units are used in two complementary ways: one, as a measure of course weighting, and the other, as an indicator of student work load:

1. As a measure of course weighting for each unit course e.g. the credit unit to be earned for satisfactorily completing the course is specified; thus a 2-credit unit course may mean two 1-hour lecture per week per semester or one 1-hour

lecture plus 3-hour practical per week per semester.

2. As a measure of work load, "One Credit Unit" means one hour of lecture or one hour of tutorial per week per semester. For other forms of teaching requiring student teacher contact, the following equivalents may apply: two hours of seminar: three hours of Engineering and Technology.

Laboratory or field work, Clinical practice/practicum, studio practice or stadium sporting activity, six hours of teaching practice; four weeks of industrial attachment where applicable.
Normally, in the Course Credit System, courses are mounted all year round, thus enabling students to participate in examinations in which they are unsuccessful or unable to participate on account of ill health or for other genuine reasons. In such a system, no special provisions are made for re-sit examinations.

The minimum number of credit units for the award of a degree in engineering and technology is 150 units, for a 5-year programme, which is subject to the usual Department and Faculty requirements. A student shall therefore qualify for the award of a degree when he has met the conditions. The minimum and maximum credit load per semester is 15 and 24 credit units respectively.

For the purpose of calculating a student's cumulative GPA (CGPA) in order to determine the class of Degree to be awarded, grades obtained in ALL the courses registered, whether compulsory or optional and whether passed or failed must be included in the computation. Even when a student repeats the same course once or more before passing it or substitutes another course for a failed optional course. Grades

scored at each and all attempts shall be included in the computation of the GPA. Pre - requisite courses must be taken and passed before a particular course at a higher level can be registered.

Course Assessment

The assessment of courses is structured into two main components namely continuous assessment and examination.

Continuous Assessment (CA)

This component involves ongoing evaluations throughout the semester or session, which may include assignments, quizzes, tests, practical, presentation and attendance or participation.

Continuous assessment provides a holistic view of student's performance and progress. The continuous assessment shall account for 40% for taught courses and 50% for laboratory-based courses. A student repeating a failed course loses the CA obtained when the course was taken previously. Thus, such a student must repeat all aspects of the course. The CA marks for a course graded 'Incomplete' shall be carried forward and added to the examination marks obtained by the student when he/she completes the course. CA must be completed, and the students must receive their results before the end of semester examination.

This component encompasses various methods of evaluating student performance throughout the semester or session. Key elements include:

- **Attendance**

Attendance can be seen as a frequency with which student has been present during lectures or other academic activities.

Monitoring attendance to gauge student engagement and participation in lectures and activities.

1. It is part of KHAIRUN regulations that no student should be allowed to sit for any course examination if he/she doesn't have 75% lecture attendance.
2. Depending on the lecturers, some marks are sometimes accorded to students who have full lecture attendance.
3. It helps in making decision to either assist students on the border line to escape carrying over or spilling over a course.

- **Practical**
  This can be explained as a part of examination or series of examinations in which the student has to demonstrate his/her practical ability. It includes laboratory or field experiment and survey. It helps student understand the theories learnt in the class. Reasonable percentage from the total assessment is accorded to practical section of all taught and practical courses.

- **Test and Quizzes**
  A test is a mini examination given to students during the academic semester to asssess understanding of course material at different stages. A quiz is a short assessment to evaluate student grasp of specific topics.
  Students should note that punishments reserved for students who involved themselves in examination malpractice are equally applicable to test and quiz malpractices. This component carry greater proportion of the continuous assessment.

- **Presentation**
  This is another component of continuous assessment in which student(s) will be asked to deliver a lecture or speech on the relevant topics in front of an audience. Some marks out of the total assessment are accorded to presentation.

- **Assignments and Projects**
  It refers to the tasks assigned to students by their lecturers to be completed outside the class. This is to assess the application of concepts and deep understanding.

End of Semester Examinations

This component consists of formal examination administered at the end of semester or session. It assesses the students understanding of the course material and their ability to integrate and apply knowledge acquired throughout the period.

i. End of semester examination should take 60% of the assessment for all taught courses and 50% of the assessment for practical-based courses.

ii. End of semester examinations should all be in essay type for all taught courses.

iii. Each credit should have a minimum of 45 minutes and a maximum of one hour of examination. However, the duration of the examination of any course should not be less than one hour, and no more than three hours, except for students with special needs, in which case additional 30 minutes is allowed.

iv. For every two-credit course there should be **five** examination questions for students to answer **three,** for one credit course **four** questions to answer **two**, and for three credit course **seven** questions to answer **five**.

v. Course tutors are at liberty to create a compulsory question as part of the total number of questions to be attempted by students. Compulsory question in any examination should not be more than one.

vi. Examination shall be administered at the end of each course, per semester.

vii. A student must have at least a 75% attendance of all lectures and practical in order to be eligible to sit for an examination in a course. This provision can only be implemented if the Department is satisfied that proper attendance record has been kept.

The procedure for marking of examination scripts shall be a matter for agreement between the examiners for the course concerned. The mark for each course shall be expressed as a percentage. A fractional mark of 0.5% or above should be rounded up to the next whole number, while fractional mark below 0.5% should be dropped.

The pass mark shall be 40% for all courses. Students will be permitted to take a paid re-sit of the failed examination, provided it is approved by the Senate. Students who fails the re-sit examination will have to carry over the failed courses to the next session.

Grading System
All the courses are graded and classified as follows:

Table 3: Grade Letter and Points

Percent Score	Grade Letter	Grade Point
70 – 100	A	5
60 – 69	B	4
50 – 59	C	3
45 – 49	D	2
40 – 44	E	1
00 – 39	F	0
Absent	ABS	0
Incomplete	I	–

Calculation of GPA and CGPA
The performance of a student in a semester will be reported by the Grade Point Average (GPA) while the overall performance at the end of a session (and/or at any point during the study) will be reported by the Cumulative Grade Point Average (CGPA). The classification of a degree shall be determined by the final CGPA .

(a) Letter Grades and Grade Points shall be derived from the actual percentage score obtained in a given course as indicated in Table 3 above: Each course is graded by a letter

using the letters A, B, C, D, E, F, and I. each letter, except I, corresponds to a range of marks as follows: A for 70-100%; B for 60-69%; C for 50-59%; D for 45-49% , E for 40-44 F for 0-39% and ABS is 0 . The grades A-E denote passes, with A being the best; the grade F denotes a failure in the course. Each letter grade, except I, is assigned a Grade point as follows: A = 5, B = 4, C = 3, D = 2, E = 1 and F = 0. No Grade Point is assigned to I.

(b) A Weighted Grade Point shall be determined for the performance in each course by multiplying the Grade point obtained in the course by the Credit load of the course, except that all incomplete courses shall be ignored .Thus, if a student obtains a 'B' in a three credit course, the points are 4×3 = 12.

(c) Grade Point Average (GPA) shall be calculated for a semester by adding up the weighted Grade Points obtained in all the courses offered in the semester and dividing the sum by the total value of the credits of all the courses, except those graded as Incomplete.

$$GPA = \frac{Total\ points\ earned\ in\ a\ semester}{Total\ number\ of\ credits\ registered\ in\ a\ semester}$$

(d) A Cumulative Grade Point Average (CGPA) shall be calculated by adding the Weighted Grade Points obtained in all the courses offered by the student in all the semesters up to the end of a given session (or up to a particular point in a student's program) and dividing the sum by the total value of the credits of all the courses registered by the student in

all semesters, ignoring credits of courses graded 'Incomplete'.

$$CGPA = \frac{Total\ points\ earned\ in\ all\ semesters\ since\ entry}{Total\ number\ of\ credits\ registered\ since\ entry}$$

Degree Classifications

Degree is classified on the basis of the final CGPA as follows:

Table 4: Bachelor Degree Classification

Final CGPA	Degree Class
4.50 – 5.00	First Class Honours
3.50 – 4.49	Second Class Upper Honours
2.40 – 3.49	Second Class Lower Honours
1.50 – 2.39	Third Class Honours
1.00 – 1.49	Pass
0.00 – 0.99	No degree awarded

Concessional Pass

A last chance spill-over student who has satisfied all the graduation requirements except in one course, and who has scored 30% or more in the said course shall be given a Concessional Pass (CP) in the affected course and be allowed to graduate. The course score is retained, and a grade of 'CP' is assigned, with zero grade point. Despite this, the course is treated as passed for graduation purpose.

Probation

A student whose CGPA is less than 1.00 at the end of any session shall be placed on academic probation for one session to enable him/her up-grade his/her CGPA to at least 1.00. Such a

student shall be informed of his/her status in writing by the Department and copy of the letter should be sent to the Dean.

Withdrawal

Withdrawal from the University shall be recommended by the Faculty Boards to the Senate on any of the following grounds:

a. Failure to register within the time set by Senate for registration.
b. Failure to obtain a CGPA of at least 1.00 after a probation period.
c. *i*) A failure rate so great that, at the point of consideration, the student would not be able to graduate within the remaining time available to him/her even if he/she is to register for, and pass, the maximum number of credits allowed by the regulations in each of the sessions available to him/her. [For example, if a student has only a maximum of two sessions to earn 90 credits but he can register for only 40 credits per session.]

ii) A failure rate so great that, at point of consideration even with "A" in the remaining course(s) a student cannot be able to go out of second probation.

d. Failure to attend classes for a period which exceeds 30 consecutive days except upon approved medical or other grounds
e. Failure to complete the stated requirements for the award of a degree within the maximum number of semesters laid down for the programme
f. Failure to sit for the entire semester examinations without any admissible reason.

Examination Misconduct and Penalties

Examination misconduct or malpractice is an offence which attracts some penalties. The following are considered to be examination misconducts:

i. Bringing prepared solutions in part or in whole into the exam hall.
ii. Possessing Smartphone, computers, PDA in the examination hall.
iii. Removal of examination script in part or in whole from the exam hall
iv. Impersonation of a candidate or agreeing to be impersonated
v. Copying from a candidate or exchange of exam scripts
vi. Causing of nuisance or sabotage in the examination hall
vii. Submitting a final year project report previously submitted by someone
viii. Aiding and abating any of the above
ix. Other actions deemed misconduct by the relevant University organ

Anyone caught and proved to have carried out examination misconduct will be penalized. The appropriate penalty is recommended by the relevant Senate Committee handling examination misconduct. Each case is treated on its own merit by the Committee, which is expected to thoroughly looked into the case and recommend the penalty as per the University rules. Depending on the gravity of the situation, the penalty could be:

a. Expulsion from the University
b. Rustication for a semester or a session
c. Warning
d. Other penalties deemed appropriate by the Senate

Names of candidates expelled, rusticated or warned will be published and recorded in the appropriate University media.

Suspension of Studies

A student cannot suspend his or her studies except under very special and genuine circumstances. These could be:

a. Sickness or medical issues
b. Maternity leave
c. Travel (for religious or national/community service)
d. Economic or financial circumstances

In all cases a request for the suspension must be written to the Dean of the Faculty through the Head of Department at least two weeks before the suspension starts. The request must be accompanied with valid documentation. Granting or approving requests for suspension of studies is not automatic but depends on the veracity of the case.

The University reserves the right to suspend the studies of a student if such suspension would resolve some serious medical, security or social issues in the University.

Engineering Curriculum

The engineering curriculum at Khalifa Isyaku Rabiu University (KHAIRUN) is based on the Core Curriculum and Minimum Academic Standards (CCMAS) introduced by the National Universities Commission (NUC) in 2022. The CCMAS is structured such that it provides 70% of the core courses for each programme, while allowing universities to provide the remaining 30%. In this regard courses provided by Khalifa Isyaku Rabiu University have KHAIRUN prefix in the course

codes. Courses provided by the NUC CCMAS do not have the prefix. We are optimistic that the curriculum will impart trendy skills and competences expected of average 21st century engineering graduate for self, national and global relevance.

First year (Level 100) courses are common to all the engineering programmes. Most of the Level 200 courses are also common to all the engineering students. Thus, in this handbook, the curriculum summary and course contents are divided into two parts namely the common *foundation courses* and *programme courses*. The latter are courses that are specific to a given programme.

Another course that is common to all engineering students is the Students Industrial Work Experience Scheme (SIWES). The course is industry-based and is taken at Levels 200, 300 and 400. However, the scores are processed at the end of the second semester of Level 400. That is to say a candidate's assessment at the end of the 2nd semester of Level 400 will consist of scores already obtained during SIWES I (i.e. SWEP), SIWES II and SIWES III.

FOUNDATION COURSES SUMMARY

Level 100 courses are common to Computer, Electrical and Mechatronics Engineering programmes except for the *introductory* courses. In this section the courses summary (lists) and contents of the foundation courses are given.

Level 100 Courses (B.Eng. Engineering Programmes)

Course Code	Course Title	Units	Status	LH	PH
GET 101	Engineer in Society	1	C	15	-
GET 102	Engineering Graphics and Solid Modelling I	2	C	15	45
GST 111	Communication in English	2	C	15	45
GST 112	Nigerian Peoples and Culture	2	C	30	-
MTH 101	Elementary Mathematics I: Algebra and Trig.	2	C	30	-
MTH 102	Elementary Mathematics II: Calculus	2	C	30	-
PHY 101	General Physics I: Mechanics	2	C	30	-

Course Code	Course Title	Units	Status	LH	PH
PHY 102	General Physics II: Behaviour of Matter	2	C	30	-
PHY 107	General Practical Physics I	1	C	-	45
PHY 108	General Practical Physics II	1	C	-	45
CHM101	General Chemistry I	2	C	30	-
CHM102	General Chemistry II	2	C	30	-
CHM107	General Practical Chemistry I	1	C	-	45
CHM108	General Practical Chemistry II	1	C	-	45
MCE104	Introduction to Python Programming	2	C	45	-
MTH104	Elementary Maths III (Vectors, Matrix, Geom)	3	C	45	-
MTH105	Basic Statistics	3	C	45	-
PHY104	General Physics III (Electricity & Magnetism)	2	C	30	15
	Total =	**33**			

Level 100 courses are common for all the engineering programmes except for the Introductory courses as follows:

Introduction to Computer Engineering is a core course for Computer Engineering students only.

Course Code	Course Title	Units	Status	LH	PH
CPE 112	Introduction to Computer Engineering	2	C	30	-

Introduction to Electrical Engineering is a core course for Electrical Engineering students only.

Course Code	Course Title	Units	Status	LH	PH
TEL 100	Introduction to Electrical Engineering	2	C	30	-

Introduction to Mechatronics Engineering is a core course for Mechatronics Engineering students only.

Course Code	Course Title	Units	Status	LH	PH
MCE 112	Introduction to Mechatronics Engineering	2	C	30	-

Level 200 Courses (B.Eng. Engineering Programmes)

Most of the Level 200 courses are common to Computer, Electrical and Mechatronics Engineering programmes. The common courses are listed below.

Course Code	Course Title	Units	Status	LH	PH
GET 201	Applied Electricity I	3	C	45	-
GET 203	Engineering Graphics and Solid Modeling II	2	C	15	45
GET 204	Students Workshop Practice	2	C	15	45
GET 207	Applied Mechanics	3	C	45	-
GET 209	Engineering Mathematics I	3	C	45	-
GET 210	Engineering Mathematics II	3	C	45	-
GET 211	Computing and Software Engineering	3	C	30	45
GST 211	Entrepreneurship and Innovation	2	C	30	-
GST 212	Philosophy, Logic and Human Existence	2	C	30	-
	Total =	**32**			

Students Industrial Work Experience Scheme (SIWES). To be credited in the 2nd Semester of Level 400.

Course Code	Course Title	Units	Status	LH	PH
GET 299	SIWES/Student Work Experience	3	C		9 Weeks

The following are the additional Level 200 courses specific to the Computer Engineering programme.

Course Code	Course Title	Units	Status	LH	PH
GET 201	Applied Electricity I	3	C	45	-
GET 203	Engineering Graphics and Solid Modeling II	2	C	15	45
GET 204	Students Workshop Practice	2	C	15	45
	Total =	7			

Course Code	Course Title	Units	Status	LH	PH
GET 202	Engineering Materials	3	C	45	-
CPE201	Introduction to Signal Processing	3	C	30	45

Course Code	Course Title	Units	Status	LH	PH
CPE202	Introduction to Machine Learning	3	C	30	45
	Total =	**9**			

The following are the additional Level 200 courses specific to the Electrical Engineering programme.

Course Code	Course Title	Units	Status	LH	PH
EEE 208	Electrical Engineering Materials	3	C	45	-
GET 206	Fundamentals of Thermodynamics	3	C	45	-
EEE201	Introduction to Signal Processing	3	C	30	45
	Total =	**9**			

The following are the additional Level 200 courses specific to the Mechatronics Engineering programme.

Course Code	Course Title	Units	Status	LH	PH
MCE201	Introduction to MATLAB Programming	2	C	30	45
MCE202	Dynamics	2	C	30	
GET208	Strength of Materials	3	C	30	
	Total =	**7**			

Foundation Course Contents
The contents of the Level 100 and Level 200 courses are given here. The contents are listed in alphabetical order of the course codes.

Level 100 Course Contents

CHM 101: General Chemistry I (KHAIRUN-CHM101)
(2 Units C: LH 30)

Course Contents
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 102: General Chemistry II (KHAIRUN-CHM102)
(2 Units C: LH 30)

Course Contents
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 107: General Practical Chemistry I
(KHAIRUN-CHM107) (1 Unit C: PH 45)

Course Contents
Laboratory experiments designed to reflect topics presented in courses CHM 101 and CHM 102. These include, acid-base titrations, qualitative analysis, redox reactions, gravimetric analysis, data analysis and presentation.

CHM 108: General Practical Chemistry II
(KHAIRUN-CHM108) (1 Unit C: PH 45)
Course Contents
Continuation of **CHM 107**. Additional laboratory experiments to include functional group analysis, quantitative analysis using volumetric methods.

CPE 112: Introduction to Computer Engineering
(2 Units C: LH 30)

Course Contents
Historical development of modern computing and computer engineering profession. Roles and responsibilities of the computer engineer. Career paths and development (public and private sectors, academic/research and industry); overview of computer engineering design; computer devices/hardware in the age of 'smartness' and Internet of Things and People (IoTs & P); identification of computer software and hardware components and operational relationships (central processing units, input/output devices, operating systems, languages).

GET 101: Engineer in Society
(1 Unit C: LH 15)

Course Contents
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, infrastructure 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.

GET 102: Engineering Graphics and Solid Modelling I
(2 Units C: LH 15; PH 45)

Course Contents
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 workspaces. 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.

GST 111: Communication in English
(2 Units C: LH 15; PH 45)

Course Contents
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 arguments, analogy, generalisation 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)

Course Contents
Nigerian history, culture and arts up to 1800 (Yoruba, Hausa and Igbo peoples and cultures); peoples and cultures of the minority ethnic groups. Nigeria under colonial rules 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. The nationalist movement and the struggle for independence. Nigeria and the challenges of nation building; military intervention in Nigerian politics; and the 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.

MCE 101: Introduction to Mechatronics Engineering
(2 Units C: LH 15)

Course Content
Introduction to mechatronics systems - Measurement Systems, Control Systems, Microprocessor-based Controllers. Sensors and Transducers; Performance Terminology, Sensors for Displacement; Position and Proximity; Velocity, Motion, Force, Fluid Pressure, Liquid Level. Temperature, Light Sensors; Selection of Sensors. Pneumatic and Hydraulic Systems; Directional Control Valves; Rotary Actuators. Mechanical Actuation Systems; Cams; Gear Trains; Ratchet and Pawl; Belt and Chain Drives; Bearings. Electrical Actuation Systems; Mechanical Switches; Solid State Switches; Solenoids; DC Motors; AC Motors; Stepper Motors. Introduction to Robot and Robotics, Three laws of robotics, History, Issues of industrial robot usage, Robot Types, limitations, Architecture and Configuration of Robots, Applications of Robots, Robots Classification, Robot Repeatability and Accuracy, Robot component, Degree of freedom, Drive Technologies, Coordinate Systems, three related frames, Rotational about fixed frames (x,y,z). Transformation of Coordinate Frame, Forward

Kinematics, Orientations, Translation of rigid body. Introduction to robotics, mobile robots, swamp robot and industrial robots, Robot Mechanisms, Actuators and Drive Systems, Differential Motion, Statics and dynamics, Force and Compliance Controls, Realistic and Safe Use of Robots

MTH 101: Elementary Maths I (Algebra and Trigonometry) (2 Units C: LH 30)

Course Contents
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, the roots of unity. Circular measure, trigonometric functions of angles of any magnitude, addition and factor formulae.

MTH 102: Elementary Mathematics II (Calculus) (2 Units C: LH 30)

Course Contents
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).

PHY 101: General Physics I (Mechanics)
(2 Units C: LH 30)

Course Contents
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 102: General Physics II (Behaviour of Matter)
(2 Units C: LH 30)

Course Contents
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 107: General Practical Physics I
(1 Unit C: PH 45)

Course Contents
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 PHY 101, 102, 103 and PHY 104). However, emphasis should be placed on the basic physical techniques for observation, measurements, data collection, analysis, and deduction.

PHY 108: General Practical Physics II
(1 Unit C: PH 45)

Course Contents
This practical course is a continuation of PHY 107 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.

TEL 100: Introduction to Electrical Engineering
(2 Units C: LH 30)

Course Contents
Electrical circuits (electrical quantities – Units, DC and AC Signals, Root-Mean-Square (RMS) Value, Average Value, Instantaneous Values, Form Factor, Crest Peak or Amplitude Factor); Electrostatics (Introduction, Capacitors, Capacitance, Capacitance of an Isolated Sphere, Spherical Capacitor, Parallel Plate Capacitor, Capacitors in Series and Capacitors in Parallel); magnetism and electromagnetism (Introduction, Absolute and Relative Permeabilities of a Medium, Magnetic Induction (Magnetic Flux Density), Flux Per Unit Pole, Field Intensity or Field Strength, the Production of Magnetic Induction by a Current, Biot-Savart Law (Laplace's Law), Magnetic Circuit, Comparison of the Electric and Magnetic Circuits Magnetisation Curves; Electromagnetic Induction; Faraday's Laws of Electromagnetic Induction); Basic laws and theorems (Introduction, Ohm's Law, Kirchhoff's Laws, Superposition Theorem, Thevenin Theorem, how to thevenize a given circuit, Delta/Star transformation and Star/Delta transformation); three phase system (Introduction, Relationship between line and phase voltage, Delta connected system with a balanced load, power with balanced 3-phase load, Measurement of Power in a 3-phase three-wire system and Power Factor Measurement); electric power (Introduction, Power in an Alternating Current Circuit, Active, Reactive and Apparent Power, Power Triangle, Power Factor, why improve Power factor, Power factor in a Capacitive Circuit, the Practical importance of Power Factor,

Effect of low Power Factor, Power Factor Corrective Equipment, Effect of reactive power consumption, Static Var Compensations for AC and DC Transmission and Industry, Typical Static Var Compensator, Advantages of Static Var Compensator, Power Factor Economics and Electricity Tariffs); introduction to electrical machines (Electric Machines and Transformers, Classification of Electrical Machines, Basic Equations of DC Machines, Operating mode of DC Machines, Transformers, Ideal Transformer and Efficiency of a Transformer); basic electronics (Introduction, Electronic Tubes, Semi-conductors, Junction Diode, Field Effect Transistor and Optoelectronics); electrical measurement (Measurement of Resistance by the Voltmetre-Ammetre Method, Ohmmetres and A.C. Bridges).

MCE 104: Introduction to Python Programming
(2 Units C: LH 30)

Course Content
The Python programming language. Python versions and installation. Python Integrated Development Environments (IDEs). Python core and modules. Object oriented programming. Python data structures: Numeric data, string data, Boolean data. Assigning Python variables. Reserved Python keywords. String functions and methods. Mathematical operators. Mathematical functions. Conversion between string and numerical data. Python data structures: Lists, Tuples and Dictionaries. Conditional statements. Program looping. User-defined Python functions. Exception handling. Python plotting libraries.

MTH 104: Elementary Mathematics III
(Vectors, Matrix and Geometry)
(2 Units; Core; LH = 30)

Course Contents
Types of vectors: points, line, and relative vectors. Geometrical representation of vectors in 1-3 dimensions. Addition of vectors and multiplication by a scalar. Components of vectors in 1-3 dimensions. Direction cosines. Linear independence of vectors. Point of division of a line 4 Scalar and vector products of two vectors. Simple applications. Two-dimensional coordinate geometry. Straight lines. The angle between two lines, distance between points. Equation of a circle, tangent and normal to a circle. Properties of parabola ellipse. Hyperbola straight lines and planes in space. Direction cosines. The angle between lines and between lines and planes. A distance of a point from a plane. Components of velocity and acceleration of a particle moving in a plane, force, momentum. Laws of motion under gravity, projectiles, and resisted vertical motion. Angular momentum. Simple harmonic motion. Elastic string. Simple pendulum, and impulse. The impact of two smooth spheres and of a sphere on a smooth surface.

MTH 105: Basic Statistics
(3 Units; Core; LH = 30)

Course Contents
Definition of statistics. Statistical data sources, collection and analysis. Types of statistics.

Descriptive statistics and inferential statistics. Measurement of location in grouped and ungrouped data. Skewness and Kurtosis. Measure of central tendencies: mean, mode, median variance, and standard deviation for grouped and un-grouped data. Time series and demographic measures and index numbers. Construction of questionnaires and simple index numbers. Use of random numbers and statistical tables. Estimation and test of hypothesis. Analysis and presentation of statistical data. Curve fitting and goodness-of-fit tests. Analysis of regression and correlation models. A measure of dispersion in grouped and un-grouped data. Deterministic and statistical (Stochastic) Models. Elements of a probability distribution. Binomial Distribution, Normal Distribution. Geometric Distributions. Poisson distribution. Negative Binomial Distributions. Exponential Distribution. Reliability function. Estimation and tests of hypothesis concerning the parameters of the distributions. Generation of statistical, events from set-theory and combinatorial methods. Elementary principles of probability. Types and distribution of random variables. The binomial, Poisson, hypergeometric and normal distributions. Expectations and moment, random variables. Probability sampling from table of random numbers. Applications of statistical principles in agricultural and biosystems engineering.

KHAIRUN-PHY104: General Physics III (Electricity and Magnetism) (2 Units; Core; LH = 30)

Course Contents

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.

Level 200 Courses' Contents

EEE 208: Electrical Engineering Materials
(3 Units C: LH 45)

Course Contents
Atomic Structure and Bonding: the internal structure of the atom will be examined and will include the electron orbital model of atomic structure. This will be extended to explain the different types of bonding, which occurs within materials. Crystal Structure: The main types of crystal lattices are to be examined and their defects; which may occur, will also be described. Properties of Materials: The main properties of materials will be described as will the methods used to quantify them. Free electron motion in static electric and magnetic fields, electronic structure of matter, conductivity in crystalline solids. Theory of energy hands in conductors, insulators and semi-conductors: electrons in metals and electron emissions; carriers and transport phenomena in semi-conductors, characteristics of some electron and resistors, diodes, transistors, photo cell and light emitting diode; Elementary discrete devices fabrication techniques and IC technology.

GET 201: Applied Electricity I
(3 Units C: LH 45)

Course contents
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, acceptance.

GET 202: Engineering Materials
(3 Units C: LH 45)

Course Contents
The material science; atomic structure, atomic bonding and crystal structures. Engineering materials situating metals and alloys; metals and alloys, classifications of metals, metal extraction processes using iron and steel (ferrous) and aluminium (nonferrous) as examples, phase diagrams/iron carbon diagrams, and mechanical workings of metals. Selection and applications of metals and alloys for specific applications in oil, aerospace, construction, manufacturing and transportation industries, among others. Ceramics (including glass); definition, properties, structure and classifications of ceramics. Bioactive and glass – ceramics. Toughing mechanism for ceramics. Polymers: definition of polymers as engineering materials; chemistry of polymeric materials, polymer crystallisation, polymer degradation and aging. Thermoplastic and thermosetting polymers and concepts of copolymers and homopolymers. Composites; definition, classification, characterisation, properties and composite. Applications of composites. Nanomaterials; definition, classification and applications of nanomaterials as emerging technology. Processing of nanomaterials including mechanical grinding, wet chemical synthesis, gas phase synthesis, sputtered plasma processing, microwave plasma processing and laser ablation. Integrity assessment of engineering materials; effect of

engineering design, engineering materials processing, selection, manufacturing and assembling on the performance and service life of engineering materials. Metallography and fractography of materials. Mechanical testing (destructive testing) of materials such as compressive test, tensile test, hardness test, impact test, endurance limit and fatigue test. Non-destructive test (NDT) such as dye penetrant, *x*-ray and eddy current.

GET 203: Engineering Graphics and Solid Modeling II
(3 Units C: LH 30; PH 45)

Course Contents
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 204: Students Workshop Practice
(2 Units C: LH 15; PH 45)

Course Contents

The course comprises of 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 205: Fundamentals of Fluid Mechanics
(3 Units C: LH 45)

Course Contents
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 206: Fundamentals of Engineering Thermodynamics
(3 Units C: LH 45)

Course Contents
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.

GET 207: Applied Mechanics
(3 Units C: LH 45)

Course Contents
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 analyse.

GET 208: Strength of Materials
(3 Units C: LH 45)

Course Content
Plane stress: Stresses on incline planes, Transformation equations for plane stress, Principal stresses and Maximum shear stress, Mohr's circle, Hooke's law for plane stress, strain energy in plane stress. Plane strain: Plane strain versus plane stress, transformation equations for plane strain, principal strain, maximum shear strain, Mohr's circle for plane strain and strains measurements. Thermal effects and combined stresses. Thick cylinders; Lame's theory; Force fits; compound cylinders. Beam Deflection Statically indeterminate beams.

GET 209: Engineering Mathematics I
(3 Units C: LH 45)

Course Contents
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 210: Engineering Mathematics II
(3 Units C: LH 45)

Course Contents
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 211: Computing and Software Engineering
(3 Units C: LH 30; PH 45)

Course Contents
Introduction to computers and computing; computer organisation – 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 299: Students Industrial Work Experience I (Students Work Experience Programme, SWEP)
(3 Units C: 9 weeks)

Course Contents
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 will be 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 level 200).

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

Course Contents
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, innovation 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 212: Philosophy, Logic and Human Existence
(2 Units C: LH 30)

Course Contents
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. Introduction to basic design and operation of digital computers (information representation.

TEL 202: Applied Electricity II
(3 Units E: LH 45)

Course Contents
Power factor; Power in AC circuit, Resonance in RLC series and parallel circuit. Three Phase Circuits: Voltages of three balanced phase system, delta and star connection, relationship between line and phase quantities, phasor diagrams. DC Machines: Construction, Basic concepts of winding (Lap and wave); DC generator; Principle of operation; EMF equation; characteristics (open circuit load) DC motors; Principle of operation; Torque Equation; Speed Torque Characteristics, (shunt and series machine); Single Phase Transformer; Constructional parts; Types of transformers; emf equation; No Load and on load operation; phasor diagram and equivalent circuit; losses of a transformer; regulation and efficiency. Calculation; Three Phase Induction Motor: Types; Construction; production of rotating field; principle of operation; Slip and Frequency; rotor emf and current; Equivalent circuit and phasor diagram; Torque Slip characteristics torque-speed characteristics; General Structure of Electrical Power System: Power generation to distribution through overhead lines and underground cables with single line diagram; Earthing of Electrical Equipment; Electrical Wiring Practice.

CPE 201: Introduction to Signal Processing,
(3 Units; Core; L 30; P 45)

Course Contents
Introduction to Signals and Systems: Continuous-Time Signals, Continuous-Time Convolution, Linear Time-Invariant Systems, properties of LTI Systems.

- Discrete-Time signals: Sampling Theory, Linear systems, discrete signals (impulse, step, exponential), Discrete-Time Convolution, Fourier-Transform; DFT and FFT.
- Digital filters: Advantages and disadvantages over analogue filters. Binomial transformation, FIR and IRR digital filters design.

Applications of DSP: STFT, speech; 2D signal processing-image filtering deconvolution; communication systems.

CPE 202: Introduction to Machine Learning,
(3 Units; Core; L 30; P 45)
Course Contents

- Introduction to Machine Learning: Overview of machine learning, history, and applications.
- Data Preparation: Data cleaning, feature selection, and feature engineering.
- Supervised Learning: Regression, classification, decision trees, and ensemble methods.
- Unsupervised Learning: Clustering, dimensionality reduction, and anomaly detection. Model Selection and

Evaluation: Cross-validation, bias-variance trade-off, and performance metrics.

EEE 201: Introduction to Signal Processing,
(3 Units; Core; L 30; P 45)

Course Contents

i. Introduction to Signals and Systems: Continuous-Time Signals, Continuous-Time Convolution, Linear Time-Invariant Systems, properties of LTI Systems.
ii. Discrete-Time signals: Sampling Theory, Linear systems, discrete signals (impulse, step, exponential), Discrete-Time Convolution, Fourier-Transform; DFT and FFT.
iii. Digital filters: Advantages and disadvantages over analogue filters. Binomial transformation, FIR and IRR digital filters design.
iv. Applications of DSP: STFT, speech; 2D signal processing-image filtering deconvolution; communication systems.

GET 208: Strength of Materials
(3 Units C: LH 45)

Course Content

Plane stress: Stresses on incline planes, Transformation equations for plane stress, Principal stresses and Maximum shear stress, Mohr's circle, Hooke's law for plane stress, strain energy in plane stress. Plane strain: Plane strain versus plane stress, transformation equations for plane strain, principal strain, maximum shear strain, Mohr's circle for plane strain and strains measurements. Thermal effects and combined stresses. Thick

cylinders; Lame's theory; Force fits; compound cylinders. Beam Deflection Statically indeterminate beams.

MCE 201: Introduction to MATLAB Programming
(2Units C: LH 30, PH 45)

MCE 202: Dynamics
(2 Units; Core; L 30; P 45)

Course Content
Kinematics of particles and rigid bodies: motion in one, two and three dimensions, relative motion, and the description of motion using vectors and coordinate systems, Kinematics of particles, Rectilinear and curvilinear motion, Relative motion: Newton's laws of motion, work and energy, impulse and momentum, and the dynamics of systems of particles, Space kinematics, Velocity and acceleration analysis, Conservation laws, Dynamics of systems of particles, Conservation of momentum and energy, Central force motion, Dynamics of rigid bodies.

Laboratory Content
i. Linear Momentum: to observe the behaviour of two colliding inelastic bodies and verify the principle of conservation of momentum.

ii. Belt drives: to determine the efficiency of drive transmission.

COMPUTER ENGINEERING PROGRAMME

This section contains the course summary and course contents for the Level 300 to Level 500 of the B.Eng. Computer Engineering programme. The summary of Level 100 and Level 200 courses and their respective contents can be found in the Foundation Courses section. The complete list of all the courses offered at various levels of B.Eng. Computer Engineering programme can be found in the Glossary.

Computer Engineering Global Course Structure

Level	General Studies	Basic Science	Discipline GET	Programme (CPE)	SIWES*	KHAIRUN	Total Units
100	4	10	3	2	-	16	35
200	4	-	22	-	3	6	35
300	4	-	15	9	4	13	45
400	-	-	-	11	8	2	21

Level	General Studies	Basic Science	Discipline GET	Programme (CPE)	SIWES*	KHAIRUN	Total Units
500	-	-	11	12	-	4	27
Total	**12**	**10**	**51**	**34**	**15**	**41**	**163**

Level 300 Computer Engineering Course Summary

Course Code	**Course Title**	**Units**	**Status**	**LH**	**PH**
CPE 301	Computer Organisation and Architecture	2	C	30	-
CPE 302	Measurement and Instrumentation	3	E	30	45
EEE 321	Analogue Electronic Circuits	2	E	15	45
EEE 322	Digital Electronic Circuits	2	E	30	
ENT 312	Venture Creation	2	C	15	45
GET 301	Engineering Mathematics III	3	C	45	-
GET 302	Engineering Mathematics IV	3	C	45	-
GET 304	Engineering Communication, Technical Writing and Presentation	3	C	45	-

Course Code	Course Title	Units	Status	LH	PH
GET 305	Engineering Statistics and Data Analytics	3	C	45	-
GET 306	Renewable Energy Systems and Technologies	3	C	30	45
GST 312	Peace and Conflict Resolution	2	C	30	-
CPE 301	System Modelling and Analysis	3	C	30	45
CPE 302	Communications Principles	2	C	30	15
CPE 303	Sensors and Actuators	2	C	30	15
CPE 304	Database Programming	3	C	30	45
CPE 305	Introduction to Image Processing	3	C	30	45
	Total =	**41**			

Students Industrial Work Experience Scheme (SIWES). To be credited in the 2nd Semester of Level 400.

Course Code	Course Title	Units	Status	LH	PH
GET 399	SIWES II	4	C		12 Weeks

Level 400 Computer Engineering Course Summary

Course Code	Course Title	Units	Status	LH	PH
CPE401	Microprocessor and Embedded Systems	3	C	30	45
CPE 403	Control System	2	C	30	-
CPE 405	Fundamentals of Software Engineering	2	C	30	-
CPE 411	Hardware Design Techniques and Verification	2	C	30	-
CPE 413	Research Methods	2	C	30	-
CPE 401	Introduction to Digital Communications	2	C	30	15
CPE 402	Operating Systems	2	C	30	
	Total =	**15**			

Students Industrial Work Experience Scheme (SIWES).

Course Code	Course Title	Units	Status	LH	PH
GET 299	SIWES I/Student Work Experience	3	C		9 Weeks
GET 399	SIWES II	4	C		12 Weeks
GET 499	SIWES III	8	C		24 Weeks
		Total =15			

Level 500 Computer Engineering Course Summary

Course Code	Course Title	Units	Status	L H	PH
GET 501	Engineering Project Management	3	C	45	-
GET 502	Engineering Law	2	C	30	-
CPE 501	Testing, Reliability and Maintainability	2	C	30	-
CPE 502	Digital Signal Processing	3	C	45	-
CPE 511	Machine Learning and Applications	3	C	45	-
GET 599	Final Year Project	6	C	-	270
CPE 501	Introduction to Computer Vision	2	C	30	15
CPE 502	Computer Network Security	2	C	30	-
	Elective Course	2	E	30	-
	Elective Course	2	E	30	-
	Total =	**27**			

Elective Courses

A student is required to select and register any two of the available elective courses. These can be taken from the elective courses in the other departments.

Course Code	Course Title	Units	Status	LH	PH
CPE 505	Digital System Design with VHDL	2	E	30	-
CPE 514	Professional Practice and Ethics	2	E	30	-
CPE 503	Cryptography & Crypto Analysis	2	E	30	-
CPE 516	Nanoelectronics and Computing System	2	E	30	-
CPE 517	Image Processing	2	E	30	-
CPE 518	Advanced Web Technonologies	2	E	30	-
CPE 519	Embedded Systems	2	E	30	-

Level 300 Course Contents

CPE 301: Computer Organisation and Architecture (3 Units C: LH 45)

Course Contents

Computer fundamentals: development of the history of computer hardware and software; hard-wired vs stored program concept; Von-Neuman architecture; Harvard architecture: principle of operation, advantages and disadvantages; single address machine; contemporary computers; computer system: block diagram, functions, examples, dataflow and control line; computer arithmetic: integer arithmetic (addition, subtraction, multiplication, division), floating-point representation (IEEE), floating-point arithmetic, arithmetic and logic unit (ALU). Introduction to CISC and RISC architecture: principle of operation, merits and demerits; storage and input/output systems: computer function (fetch and execute cycles), interrupts, interconnection structures (bus structure and bus types); overview of memory system, memory chip organisation and error correction, cache memory, and memory storage devices; overview of I/O, programmed and interrupt-driven I/Os, DMA, I/O channel and I/O processor; control unit: micro-operations, control of the CPU, hard-wired implementation, control unit operation, micro-instruction sequencing and execution, and micro-programmed control; using INTEL family, and MOTOROLA family as the case study of a CISC computer system. Instruction set and register: machine instruction characteristics, types of operands and operations, instruction functions, addressing modes, instruction formats,

register organisation, and instruction pipelining; high performance computer systems: techniques to achieve high performance, pipelining, storage hierarchy, and units with function dedicated for I/O; RISC, introduction to superscalar processor, and parallel processor; using popular RISC processor (e.g. i960, Motorola PowerPC) as case study. Operating system: overview of operating system, dimension and type of operating system: high level scheduling, short-term scheduling, I/O scheduling, memory management, virtual memory, UNIX/LINUX operating system: architecture, commands, programming; window-based operating systems (MS windows).

CPE 302: Measurement and Instrumentation
(3 Units E: LH 30; PH 45)

Course Contents
Transducers and applications; general instrumentation, basic meters in DC measurement, basic meters in AC measurements, rectifier, voltmeter, electro-dynamometer, and wattmeter, instrument transformers, DC and AC bridges and their applications general form of AC bridge, universal impedance bridge, electronic instruments for the measurement of voltage current resistance and other circuit parameters, electronic voltmeters, AC voltmeters using rectifiers, electronic multi meter, digital voltmeters; oscilloscope, vertical deflection system horizontal deflection system, probes, sampling CRO; and electronic function generators.

EEE 321: Analogue Electronic Circuits
(3 Units E: LH 30; PH 45)

Course Contents
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 storage amplifiers using BJTs and FETs.

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

Course contents
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.

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

Course Contents
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 & 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 & 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, etc. Digital business and e-commerce strategies).

GET 301: Engineering Mathematics III
(3 Units C: LH 45)

Course Contents
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 302: Engineering Mathematics IV
(3 Units C: LH 45)

Course Contents
Series of 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. RungeKutta and other methods in the solutions of ODE and PDEs. Numerical integration and differentiation.

GET 304: Technical Writing and Communication
(3 Units C: LH 45)

Course Contents
A brief review of common pitfalls in writing. Principles of clear writing (punctuations and capitalization). Figures of speech. Units of grammar. Tenses and verb agreements. Active and passive sentences. Lexis and 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 writing – business report and proposal, business letter, internal and external 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 305: Engineering Statistics and Data Analytics
(3 Units C: LH 45)

Course Contents
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 306: Renewable Energy Systems and Technology
(3 units C: LH 30; PH 45)

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; transesterification 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)

Course Contents
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 the completion of 300 level examination). 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 Solid works: software capabilities, design methodologies and applications. Basic part modelling: sketching with SolidWorks, building 3D components, using extruded Bose base · Basic assembly modelling, and solid Works 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.

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

Course Contents

The concepts of peace, conflict and security in a multi-ethnic nation. Types and theories of conflicts: Tribal, ethnic, religious, social, 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, Zango Kataf, chieftaincy and land disputes, cattle rustling, famers/herders conflict, cattle routes, *Ruga*, *Burtali* etc. Peace building, management of conflicts and security: Peace & Human Development. Approaches to Peace & Conflict Management the example of community reorientation committee (CRC), (religious leaders, government, community leaders, etc.). Elements of peace studies and conflict resolution: Conflict dynamics assessment Scales: Constructive & 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 & 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.

CPE 301: System Modelling and Analysis
(3 Units; Core; L 30; P 45)

Course Contents

Introduction to system models, uses, applications. Advantages and importance of simulations.

Basic concept of White box, Black box and Grey *box* modelling technique.

i. Types of models; Dynamics models, Linear models, Nonlinear models, Time domain models, Frequency domain models, LTV, LTI models (Only definition and the basics required, not fully detailed). Transfer function models: transfer function concept, i.e. Poles and zeros, system order, system type, stability.
ii. Laplace Domain: Introduction to Laplace Domain and its relationship to system modelling. Modelling of electrical, mechanical, fluid, thermal and electromechanical systems in Laplace domain and simulation of the system behaviour. Input signals; impulse, unit step, ramp, sinusoidal signals.
iii. *Z*-domain: Definitions, *z*-transform properties, zero order hold, pole and zero plots in *z*-plane, conversion from *s*-domain to *z*-domain. *z*-plane roots and stability, difference equation.
iv. System responses of first order systems, time constant, D.C gain, equation in Laplace and time domain. System responses second order systems, transient and steady state response, rise time, delay time, peak over shoot, settling time, natural frequency and damping ratio.

v. Introduction to System Identification: modelling of first order system via identification. DC motor parameter identification.

CPE 302: Communication Principles
(3 Units; Core; L = 30; P = 45)

Course Contents
Models of telecommunication system. The concept of information volume. Characteristics of analogue audio and video signals. Analogue modulation techniques and their implementation: amplitude and angle modulation, Frequency Division Multiplexing. Digitization of analogue signals. Binary system. Arithmetic operations on binary numbers. Modulo 2 arithmetic. Pulse code modulation (PCM), sampling, quantization, coding. Delta and differential pulse code modulation. Synchronous and asynchronous, static and dynamic time division multiplexing. Plesio-synchronous digital hierarchy, primary group, secondary group, groups of higher levels. Synchronous digital hierarchy. Multiplexing PDH signals into SDH STM-1 transport module. Transmission media. Optical fibres: single mode, multimode. Optical cables. Wavelength division multiplexing (WDM): Dense wavelength division multiplexing (DWDM).

CPE 303: Sensors and Actuators
(2 Units; Core; L 30; P 30)
Course Contents

Fundamental Sensor Concepts: Sensor characteristics: transfer function, range and sensitivity, errors and calibration, accuracy and precision, linearity, hysteresis.

Sensors for position, displacement, level and flow, occupancy, sensors for velocity, acceleration, force and strain, sensors for radiation: sources, detectors, optical circuit components, sensors for temperature: reference points, thermos resistive and thermoelectric sensors.

i. Sensor interfaces: bridge circuits, capacitance–to-voltage and light-to-voltage converters Sensing electronic circuits: input characteristics, excitation circuits, overview of amplifiers, amplifier noise (mechanisms, noise figure, noise model).
ii. Electrical Actuators: Review of Electrical Motors and their types, Motor Equations, Drivers, and Control of DC Motors and Stepper Motors.
iii. Hydraulic Actuators: Pumps and its different types, Hydraulic Motors and its different types, Valves and its different types. Cylinders, Accumulators, Intensifiers, Lifts, Couplings, Torque Converters. Hydraulic Circuit Design and Analysis.
iv. Pneumatic Actuators: Compressors, fluid conditioners, Pneumatic cylinders, Valves and Plugs, Basic Pneumatic Circuit Design & Analysis, Accumulator system Analysis. Translational mechanics: circuit analogies, transducers and energy harvesting.

CPE 304: Database Programming,
(2 Units; Core; L = 30; P = 30)

Course Contents

i. Database: Introduction to MIS. Important concepts and terminology associated with relational databases. (Using SQLite database)
ii. Introduction to SQL: Data Definition Language, Data Manipulation Language. Create and run SQL commands to create tables, use data types, and add rows to tables. Performing CRUD (Create, Retrieve, Update, Delete) operations.
iii. App Design using Android open source and windows app using C#.

CPE 305: Introduction to Image Processing
(3 Units; Core; L = 30; P = 45)

Course Contents

1. Introduction to Digital Image Processing: Overview of digital images, image acquisition, and the basics of image processing.
2. Image Enhancement: Techniques to improve the visual appearance of an image, such as contrast stretching, histogram equalization, and spatial filtering.
3. Image Restoration: Techniques to remove noise and other artifacts from images, such as median filtering, Wiener filtering, and deconvolution.
4. Image Segmentation: Techniques to separate an image into different regions or objects, such as thresholding, region growing, and edge detection.

5. Image Analysis: Techniques to extract useful information from images, such as feature extraction, object recognition, and pattern recognition.
6. Applications of Image Processing: Examples of image processing applications in various fields, such as medical imaging, remote sensing, and computer vision.

Level 400 Course Contents

CPE 401: Microprocessor and Embedded Systems
(3 Units C: LH 45)

Course Contents
A basic microprocessor system: the CPU, memory, I/O, and buses subsystems, basic operation of a microprocessor system: fetch and execute cycle, the architecture of some typical 8-bit, 16-bit microprocessors (Intel, Motorola) and their features; programming model in real mode: registers, memory, addressing modes; organisation of the interrupt system, interrupt vectors, and external interrupts, implementation of single and multiple interrupts in real mode; programming model in protected mode: registers, memory management and address translation, descriptor and page tables, system control instructions, multitasking and memory protection, addressing modes, and interrupt system; memory interfacing and address decoding; I/O interfacing: memory mapped i/o, isolated i/o, bus timing, i/o instructions; peripheral devices interfacing: 8255 PPI/6821 PIA, 8251 USART/6821 UART, DMA, Timer/Counter chips, etc; instruction set; assembly language Programming of Intel and Motorola microprocessors; and discussion of a typical system e.g. IBM PC, Apple Macintosh.

CPE 403: Control Systems
(2 Units C: LH 30)

Course Contents
Basic concepts and examples of control systems; Feedback, Time response analysis, concept of stability, Routh-Hurwitz criterion; Root-locus techniques, Frequency-response analysis, Polar and Bode plots, Nyquist stability criteria. Nichol's chart, compensation techniques; introduction to non-linear systems.

CPE 405: Fundamentals of Software Engineering
(2 Units C: LH 30)

Course Contents
Introduction to software engineering fundamentals; object-oriented programming; number representations; data structure and algorithms, Abstraction, modules and objects; designing for efficiency; object-oriented software design and implementation.

CPE 411: Hardware Design Techniques and Verification
(2 Units E: LH 30)

Course Contents
Elements of digital computer design; control unit, micro-programming, bus organisation and addressing schemes; micro-processors, system architecture, bus control, instruction execution and addressing modes; machine codes, assembly language and high-level language programming, micro-processors as state machines; microprocessor interfacing: input/output; technique, interrupt systems and direct memory access; interfacing to analogue systems and applications to

D/A and A/D converters; system development tools: simulators, EPROM programming, assemblers and loaders, overview of available microprocessor application.

CPE 413: Research Methods
(2 Units E: LH 30)

Course Contents
Origins and definitions of research: problem identification and formulation; research types/design; qualitative, quantitative and mixed methods of research; measurement; sampling; data analysis; interpretation of data and technical report writing; use of encyclopedia, research guides, handbooks, academic databases for computing and computer engineering discipline; use of tools/techniques for research production: referencing formats/styles and software; research management and reporting best practices; definitions of plagiarism, types, detection software; basics of document analysis, systematic review and management methods; practical documentation/presentation projects/seminars presentations.

GET 499: Students Industrial Work Experience III
(8 Units C: 24 weeks)

Course Contents
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 an 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.

CPE 401: Introduction to Digital Communications
(3 Units; C; L 30)

Course Contents

1. Introduction to Digital Communications: Overview of digital communication systems, history, and applications.
2. Digital Modulation Techniques: Amplitude Shift Keying (ASK), Frequency Shift Keying (FSK), Phase Shift Keying (PSK), and Quadrature Amplitude Modulation (QAM).
3. Channel Coding: Block codes, convolutional codes, and Turbo codes.
4. Signal Detection and Estimation: Optimum receiver, matched filter, and decision-making.
5. Error Analysis: Bit Error Rate (BER), Symbol Error Rate (SER), and Signal-to-Noise Ratio (SNR).
6. Applications of Digital Communications: Telecommunications, wireless communication, and other fields

Level 500 Course Contents

CPE 501: Testing, Reliability and Maintainability
(2 Units C: LH 30)

Course Contents
Introduction to reliability, maintainability, availability, elementary reliability theory; application to power systems and electronic components; test characteristics of electrical and electronic components; types of faults; designing for higher reliability; packaging, mounting, ventilation; protection from humidity, dust.

CPE 502: Digital Signal Processing
(3 Units C: LH 45)

Course Contents
Discrete signals and *z*-transform, digital fourier transform, fast fourier transform; the approximation problem in network theory; synthesis of low-pass filters; spectral transforms and their application in synthesis of high-pass and band-pass filters; digital filtering, digital transfer function aliasing, one-dimensional recursive and non-recursive filters; computer techniques in filter synthesis, realisation of filters in hardware and software; and basic image processing concepts.

GET 501: Engineering Project Management
(3 Units C: LH 45)

Course Contents

Fundamentals Project Management – 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 502: Engineering Law
(2 Units C: LH 30)

Course Contents
Common Law: history of common law, 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 of the termination of contract. Terms of Contracts; suppliers' duties, Damages and other Remedies. Termination/cancellation of contract Liquidation and Penalties; exemption clauses, safety and risks. 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.

CPE 505: Digital System Design with VHDL
(2 Units E: LH 30)

Course Contents
Finite state machine: definitions, 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 sub-programmes); structural level modelling, register-transfer level modelling, FSM with data path level modelling, algorithmic level modelling; introduction of ASIC, types of ASIC, ASIC design process, standard cell ASIC synthesis, FPGA design paradigm, FPGA synthesis, FPGA/CPLD architectures; VHDL Design: top-down design flow, verification, simulation alternatives, simulation speed, formal verification, recommendations for verification, writing RTL VHDL code for synthesis, top-down design with FPGA; VHDL synthesis, optimisation and mapping, constraints, technology library, delay calculation, synthesis tool, synthesis directives; and computer-aided design of logic circuits.

CPE 511: Machine Learning and Applications
(3 Units C: LH 45)

Course Contents
Introduction to machine learning; introduction to R or Python for machine learning: statistics for analytics: descriptive statistics, inferential statistics, estimation and hypothesis testing, ANOVA. Machine learning: unsupervised learning – clustering,

supervised learning – classification, decision trees, random forest, and model performance measures.

CPE 514: Professional Practice and Ethics
(2 Units E: LH 30)

Course Contents
Engineering profession: Structure and specializations (Nigeria and abroad), engineering basics; development of engineering profession; ethics and computer engineering, strands in ethical thinking, organisations and their structures: limited liability companies, private and public, partnerships, sole traders, special features of limited companies, responsibilities of directors. Company finance: the need for capital; investment and working capital; sources of funds; equity capital and loan capital, cash flow and its importance. Costing: fixed costs and variable costs; overheads; opportunity costs; depreciation; problems of cost allocation; budgeting; assessment of capital investment; discounted cash flow analysis, with particular reference to investment in software tolls and new product development; financial accounts: balance sheets, profit and loss accounts; cash flow statements; the treatment of software in company accounts; ownership of rights in software as goodwill. Anatomy of software house: the company, company structure, management of staff, producing of budget; monitoring financial performance, producing budgets. Computer contracts and intellectual property rights: the nature and types of intellectual property; intellectual property law (confidentiality, copyright, trademarks, and patents) and implications for the computing, computer engineering and software industry; computer misuse and criminal law:

computing and criminal activity, reform and criminal law, categories of misuse, computer fraud, unauthorized access ;data protection: data protection and privacy, the impact of the internet; sociology of data management/processing: generation, users, regulation/control and general management; Professional and industry codes of conduct (local and international).

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

Course Contents
Individual student or group of students' are to undertake projects to deepen their knowledge, to strengthen their practical experience and to 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 computer engineering degree.

CPE 501: Introduction to Computer Vision
(2 Units; Core; L30; P15)

CPE 502: Nanoelectronics and Computing Systems, (3 Units; Core; L = 30; P = 45)

Course Contents
Modelling of microelectronic devices, basic microelectronic circuit analysis and design, physical electronics of

semiconductor junction and MOS devices, relation of electrical behaviour to internal physical processes, development of circuit models, and understanding the uses and limitations of various models. The course uses incremental and large-signal techniques to analyze and design bipolar and field effect transistor circuits; with examples chosen from digital circuits, single-ended and differential linear amplifiers, and other integrated circuits.

Elective Course Contents

CPE 503: Cryptography & Crypto Analysis (2 Units; Core; L = 30; P = 15)

A student is required to select and register any two of the available elective courses. These can be taken from the elective courses in the other departments.

ELECTRICAL ENGINEERING PROGRAMME

This section contains the course summary and course contents for the Level 300 to Level 500 of the B.Eng. Electrical Engineering programme. The summary of Level 100 and Level 200 courses and their respective contents can be found in the Foundation Courses section. The complete list of all the courses offered at various levels of B.Eng. Electrical Engineering programme can be found in the Glossary.

Electrical Engineering Global Course Structure

Level	General Studies	Basic Science	Faculty GET	Programme (EEE)	SIWES*	KHAIRUN	Total Units
100	4	13	3	2	-	13	35
200	4	-	22	6	3	3	38
300	4	-	15	13	4	9	45
400	-	-	-	8	8	8	24
500	-	-	5	6	-	14	25
Total	**12**	**13**	**45**	**35**	**15**	**47**	**167**

Level 300 Electrical Engineering Course Summary

Course Code	Course Title	Units	Status	LH	PH
EEE 321	Analogue Electronic Circuits	2	C	30	
ENT 312	Venture Creation	2	C	15	45
GET 301	Engineering Mathematics III	3	C	45	-
GET 304	Technical Writing and Communication	3	C	45	-
GET 305	Engineering Statistics and Data Analytics	3	C	45	
GET 306	Renewable Energy Systems and Technology	3	C	30	45
GET 307	Intro. to AI, ML and Convergent Technologies	3	C	45	
GST 312	Peace and Conflict Resolution	2	C	30	
TEL 303	Electric Circuit Theory	2	C	30	
TEL 304	Measurements and Instrumentations	2	C	30	
TEL 305	Electrical Machines	3	C	45	

Course Code	Course Title	Units	Status	LH	PH
TEL 322	Electrical Energy Systems	2	C	30	
TEL 324	Electromagnetic Theory	2	C	30	
EEE 301	System Modelling and Analysis	3	C	30	45
EEE 302	Digital Electronics	2	C	30	15
EEE 303	Communications Principles	2	C	30	15
EEE 304	Sensors and Actuators	2	C	30	15
	Total =	**41**			

Students Industrial Work Experience Scheme (SIWES). To be credited in the 2nd Semester of Level 400.

Course Code	Course Title	Units	Status	LH	PH
GET 399	SIWES II:	4	C		12 Weeks

Level 400 Electrical Engineering Course Summary

Course Code	Course Title	Units	Status	LH	PH
TEL 401	Advanced Renewable Energy Systems	2	C	30	
TEL 402	Software Applications in Electrical Engineering	2	C	15	60
TEL 421	Control Engineering	2	C	30	
TEL 423	Power Electronics	2	C	30	
EEE 401	Artificial Intelligence and Applications	2	C	30	15
EEE 402	Integrated Systems Design Project	3	C	30	45
EEE 403	AC Machines	3	C	30	45
	Total =	**16**			

Students Industrial Work Experience Scheme (SIWES)

Course Code	Course Title	Units	Status	LH	PH
GET 299	SIWESI/ Students Work Experience Program	3	C		9 weeks
GET 399	SIWES II	4	C		12 weeks
GET 499	SIWES III	8	C		24 weeks
	Total =	**15**			

Level 500 Electrical Engineering Course Summary

Course Code	Course Title	Units	Status	LH	PH
GET 501	Engineering Project Management	3	C	45	-
GET 502	Engineering Law	2	C	30	-
TEL 502	Electrical Services Design	2	C	30	-
TEL 507	Electric Power Systems Engineering	2	C	30	-
EEE 501	Analog Electronics Laboratory	3	C	30	45
EEE 502	Power Electronics Laboratory	3	C	30	45

EEE 503	Electric Drives	2	C	30	15
EEE 504	Final Year Project	6	C	30	45
	Elective Course	2	E	30	
	Elective Course	2	E	30	
	Total =	**27**			

Elective Courses

Elective Courses (a student is expected to select and register two elective courses)

Course Code	Course Title	Units	Status	LH	PH
TEL 503	Energy Economy	2	E	30	-

A student is required to select and register any two of the available elective courses. These can be taken from the other departments.

Level 300 Course Contents

EEE 321: Analogue Electronic Circuits
(2 Units C: LH 30)
Course contents
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.

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

Course Contents
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 & 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 & 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 etc. Digital business and e-commerce strategies).

GET 301: Engineering Mathematics III
(3 Units C: LH 45)

Course Contents
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. Multi-valued Functions. Analytical Functions. Cauchy Riemann's Equations. Singularities and

Zeroes. Contour Integration including the use of Cauchy's Integral Theorems. Bilinear transformation.

GET 304: Technical Writing and Communication
(3 Units C: LH 45)

Course Contents
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 and structure Fog Index concept. Skills for communication and communication algorithm. Types and goals of communications; Interpersonal communication; features and the Finger Model or A,B,C,D,E of good interpersonal communications (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 reports and proposals, business letter, memoranda, 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 305: Engineering Statistics and Data Analytics
(3 Units C: LH 45)

Course Contents
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 306: Renewable Energy Systems and Technology
(3 Units C: LH 30; PH45)

Course Contents
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 laying more with emphasis on meeting 21st century national, regional and global energy needs in a sustainable situation. 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. Transesterification 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 307: Introduction to Artificial Intelligence, Machine Learning and Convergent Technologies
(3 Units C: LH 45)

Course Contents
Concepts of human and artificial intelligence; artificial/computational intelligence paradigms; search, logic and learning algorithms. Machine learning and nature-inspired algorithms: examples; are 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 399: Students Industrial Work Experience II
(3 Units C: 12 weeks)

Course Contents
On-the-job experience in industry chosen for practical working experience but not necessarily limited to the student's major courses (Students are to proceed on three months of work experience which is 12 weeks during the long vacation following the completion of the 300 level). Students are to be 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; which involves 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.

1. **Introduction to Solid works:** software capabilities, design methodologies and applications.

2. **Basics part modelling:** sketching with SolidWorks, building 3D components, using extruded Bose base. Basic assembly modelling, and solid Works 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:

1. design of machine components;
2. product design and innovation;
3. part modelling and drafting in SolidWorks; and
4. technical report writing.

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

Course Contents

The concepts of peace, conflict and security in a multi-ethnic nation shall be treated. Types and theories of conflicts: Tribal,

ethnic, religious, social 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, farmers/herders conflict, cattle rustling, boundaries/boarder disputes, political disputes, ethnic disputes and rivalries, economic inequalities, social disputes. Nationalist movements and agitations; selected conflict case studies – Tiv-Jukun, Zangon-Kataf, Ife/Modakeke, Agulere/Omulen, Fulani/Birom chieftaincy and land disputes, etc. Peace building, management of conflicts and security: Peace & Human Development. Approaches to Peace & Conflict Management (religious, government, community leaders, etc.). Elements of peace studies and conflict resolution: Conflict dynamics assessment Scales: Constructive & 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 and 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 & 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.

TEL 303: Electric Circuit Theory
(2 Units C: LH 30)

Course Contents
Basic Concepts:
Introduction, Systems of Units, Charge and Current, Voltage, Power and Energy, Circuit Elements.

i. **Basic Laws:** Ohm's Laws, Nodes, Branches, and Loops, Kirchhoff's Laws, Series Resistors and Voltage Division, Parallel Resistors and Current Division, Wye-Delta Transformations. Methods of Analysis: Nodal Analysis, Nodal Analysis with Voltage Sources, Mesh Analysis, Mesh Analysis with Current Sources, Nodal and Mesh Analyses by Inspection, Nodal Versus Mesh Analysis.

ii. **Circuit Theorems:** Linearity Property, Superposition, Source Transformation, Thevenin's Theorem, Norton's Theorem, Derivations of Thevenin's and Norton's Theorems, Maximum Power Transfer.

iii. **Operational Amplifiers:** Operational Amplifiers, Ideal Op Amp, Inverting Amplifier, Noninverting Amplifier, Summing Amplifier, Difference Amplifier, Cascaded Op Amp Circuits, Op Amp Circuit Analysis.

iv. **Capacitors and Inductors:** Series and Parallel Capacitors, Inductors, Series and Parallel Inductors.

v. **First Order Circuits:** The Source-free RC Circuit, The Source-free RL Circuit, Singularity Functions, Step

Response of an RC Circuit, Step Response of an RL Circuit, First-order Op Amp Circuits.

vi. **Second Order Circuits***:* Finding Initial and Final Values, The Source-Free Series RLC Circuit, The Source-Free Parallel RLC Circuit, Step Response of a Series RLC Circuit, Step Response of a Parallel Circuit, General Second-Order Circuits, Second-Order Op Amp Circuits.

Sinusoidal steady-state analysis. AC circuit power analysis. Polyphase circuits. Magnetically coupled circuits; Complex frequency and Laplace transform; Circuit analysis and the s-Domain; Frequency response: Bode Diagram. Fourier circuit analysis.

TEL 304: Measurements and Instrumentation
(2 Units C: LH 30)
Learning Outcomes

Course Contents

i. **Introduction:** Significance of Measurement and block diagram of Measurement System, Static characteristics- Accuracy, Precision, Sensitivity, Linearity, Repeatability, Reproducibility, Resolution, Threshold, Drift, Stability, Dead zone, hysteresis, Dynamic Characteristics- speed of response, measuring lag, fidelity, dynamic error, Types of Errors – Gross error, systematic errors, Random errors.

ii. **Measuring Instruments:** PMMC, DC voltmetre and current metres and its Extension ranges, True RMS Responding Voltmeter, Average responding rectifier type

voltmetre, electronic voltmetre, block diagram approach for measurement of voltage, current and Resistance using Digital Multi Metre (DMM), Basic Potentiometer Circuit, Q-meter – Series Method.

iii. **Bridges and Analysers:** DC Bridge- Wheatstone bridge, Kelvin's Double Bridge, AC

Bridge- Maxwell's Bridge, Schering bridge and Wien's Bridge. Signal Analysers: Frequency Selective and Heterodyne Wave Analysers, Harmonic distortion Analysers, Total Harmonic distortion, Spectrum Analysers.

i. **Oscilloscopes:** Cathode Ray Tube (CRT), Electrostatic Deflection, Post-deflection and Acceleration of Electron Beam, Screens for CRT's, Block diagram of CRO, Time-based Generator, Delay line, Attenuators, probes, Dual beam oscilloscope, Dual trace oscilloscope, Digital Storage Oscilloscope, Applications of CRO: Measurement of Phase and Frequency using Lissajous Patterns.

ii. **Transducers:** Transducer and its classification, ideal features of Transducer – Resistive.

iii. **Transducer:** Potentiometric type, Strain Gauge type (Gauge factor derivation, SG materials, Bonded and unbounded strain gauges), Capacitive Transducers - Variable gap type, variable area type and variable Dielectric type, Inductive Transducers - LVDT, Thermocouple, Thermistor, Piezoelectric Transducers, Piezoelectric effect, Piezoelectric materials, RTD, photo voltaic cell, LDR.

TEL 305: Electrical Machines
(3 Units C: LH 45)

Course Contents
DC Machine; Introduction to Machinery Principles; Rotational motion; Newton's Law and power relationships; the Magnetic field; Magnetic Circuit with air gap; Faraday's law; Production of induced force on wire; Induced voltage on a conductor moving in a magnetic field; Linear DC machine.; DC Machinery Fundamentals: Simple rotating loop between curved pole faces; Commutation; Construction; Simple armature winding; Armature reaction; Interpoles; compensating winding and brush shifting; Internal generated voltage and induced torque equations of real machines; DC Generators; Introduction; Voltage regulation; Magnetization curve; Equivalent circuits; Working and characteristics of separately excited; shunt; series and compounded generators; Parallel operations of direct current generators; DC Motors; Introduction; Speed regulation; Equivalent Circuits; Working and Characteristics of separately excited; Shunt and Permanent magnet; Working and Characteristics of series and compounded motors; Torque–speed Equations; Efficiency calculations; Stepper Motor and Drive circuit.; AC Machines Topics; Transformer Fundamentals; Importance of transformers; Types and construction; The ideal transformer; Leakage reactance; Theory and operation of single phase transformer; Losses and phasor diagram; the equivalent circuit of a real transformer; No load and short circuit test; the per unit system; the transformer voltage regulation and efficiency; Autotransformers and concept of its power rating advantages; Current transformer (CT) and

Potential transformer (PT); Three phase Transformers; Construction of power Transformer; Three phase connections and harmonics suppression; Vector groups; Three phase transformer using two transformers; Transformer ratings and related problems. Transformer Inrush Current; AC Machines Fundamentals; A simple loop in a uniform magnetic field; Review of three phase generation; Proof of the rotating magnetic field concept and its relation with no. of poles; the relationship between electrical and mechanical degree; the relationship between electrical frequency and the speed of the magnetic field rotation Induced voltage and induced torque; Losses and power flow diagram; Voltage regulation and speed regulation. Synchronous Generator; Construction; Excitation system; Equivalent circuit of Synchronous Generator; Phasor diagram; Power and Torque; Measurement of model parametres; Effect of load changes on a generator; Parallel operation of generators; Synchronous Motor; Basic principle of motor operation; Equivalent circuit; Torque speed characteristics; Power and torque equation; Phasor diagram; the effects of load change; and field current change; V-curves of synchronous motor and power factor correction; Starting of synchronous motor; Synchronous motor ratings; Three Phase Induction Motor; Construction; Basic concepts and working principles; Synchronous speed; Slip and its effect on rotor frequency and rotor voltage; Equivalent circuit; Power and torque; Torque speed characteristics; losses; efficiency and power factor; Single Phase and Special Purpose Motors; The Universal motor; Introduction to single phase induction motor; Starting single phase induction motors; Split phase windings; Capacitor start motor; Permanent split capacitor motor;

Capacitor start and capacitor run motors; Shaded pole motors; Reluctance motors; the Hysteresis motor.

TEL 322: Electrical Energy Systems
(2 Units E: LH 30)Course Contents

i. **Generation of electric energy:** Sources of energy. Heat value of fuels. Thermal stations. Hydroelectric stations. Nuclear stations.

ii. **Economics of power supply:** Fixed and running charges in electric power production. Load curves and load duration curves including concept of base, intermediate and peak load. Definition of load factor, maximum demand, Diversity factor and their effects on generation. Distribution system: Survey of power system components: feeders, distributors, services mains, radial and ring-man systems. Voltage drops in distribution systems. Per-unit qualities.

iii. **Overhead transmission system:** Conductors and insulators. Transmission line parameters. Resistance, inductance and capacitance. Skin effect. Corona discharge. Stringing: Calculation of sag and tension. Stringing chart and performance. Representation of short and long power lines. Underground cables: Types. Inductance of concentric cables. Capacitance of single-core and three-core cables. Thermal characteristics. Sheath currents. Circuit breakers: Principles of arc-extinction. Types of circuit breakers. Current growth in a purely inductive circuit. Interpretation of circuit breakers lest oscillographs.

Current chopping. Resistance and capacitance switching. Breaking and making currents.

TEL 324: Electromagnetic Theory
(2 Units E: LH 30)

Course Contents
Electromagnetics Motion and Vector algebra; Integral calculus; Curvilinear coordinates; Divergence and Stokes's theorem; Coulomb's law; Electric field; Electrostatics Gauss's Law; Electric potential; Conductors; Dielectrics; Capacitance; Capacitors; Electrostatics Energy and Forces; Poisson's Equation; Method of Images; Boundary Value Problems; Current Density; Ohm's Law; Kirchhoff's and Joule's Laws; Magnetostatics Vector Magnetic Potential; The Biot-Savart Law; the Magnetic Dipole; Magnetic Materials; Boundary Conditions; Inductors; Energy; Forces; Electrodynamics Electromagnetic Induction; Maxwell's equations, Potential Functions, Boundary Conditions, Wave Equations; Review of EM laws in integral form; Gauss law. Ampere's law and Faraday's laws; uniform EM plane waves: Magnetic fields in and around current carrying conductors. Conduction and displacement currents; Derivation of Maxwell's equations in curl form from Faraday's and Ampere's laws; Time varying electric and magnetic fields in free space the wave equation; Plane waves in vacuum, dielectric conducting and lossy media; Skin effect; Polarisation of waves; Poynting vector and energy propagation in free space; Boundary conditions; Plane waves in unbounded dielectric media. Reflection and transmission of plane waves. EM radiating systems: Antennae - isotropic antenna, elementary dipole near the far fields. Antenna

parametres. Half-wave antennae. Practical antennae e.g. loop, horn and parabolic.

EEE 301: System Modelling and Analysis,
(3 Units; Core; L 30; P 45)

Course Contents
Introduction to system models, uses, applications. Advantages and importance of simulations.

Basic concept of *White box, Black box* and *Grey box* modelling technique.

Types of models; Dynamics models, Linear models, Nonlinear models, Time domain models, Frequency domain models, LTV, LTI models (Only definition and basics required, not fully detailed). Transfer function models: transfer function concept, i.e. Poles and zeros, system order, system type, stability.

Laplace Domain: Introduction to Laplace Domain and its relationship to system modelling. Modelling of electrical, mechanical, fluid, thermal and electromechanical systems in Laplace domain and simulation of the system behaviour. Input signals; impulse, unit step, ramp, sinusoidal signals.

Z-domain: Definitions, Z-transform properties, zero order holder, pole and zero plots in Z-plane, conversion from S-domain to Z-domain. Z-plane roots and stability, difference equation.

System responses of *first order* systems, time constant, D.C gain, equation in Laplace and time domain. System responses

second order systems, transient and steady state response, rise time, delay time, peak over shoot, settling time, natural frequency and damping ratio.

Introduction to System Identification: modelling of first order system via identification. DC motor parameter identification. *Introduction to ANN model*

EEE 302: Digital Electronics,
(3 Units; Core; L = 30; P = 45)

Course Contents
Digital systems and their applications, Number systems and codes, Decimal, binary, octal, and hexadecimal number systems, Binary codes (BCD, Gray code, etc.), Boolean algebra and logic gates, Boolean algebra and its laws, Logic gates and their characteristics, Boolean functions and truth tables.

Combinational circuits: Combinational logic circuits, Adders, subtractors, multiplexers, demultiplexers, encoders, and decoders.

Sequential circuits: Sequential logic circuits, Flip-flops (SR, D, JK, T), registers, and counters.

Minimization techniques, Karnaugh maps and Boolean algebraic manipulation, Quine-McCluskey method.

Digital system design: Design of digital systems using basic building blocks, Timing diagrams and state diagrams.

Applications of digital electronics: Digital signal processing, Digital communication systems, Digital control systems.

EEE 303: Communication Principles,
(3 Units; Core; L = 30; P = 45)

Course Contents
Models of telecommunication system. The concept of information volume. Characteristics of analogue audio and video signals. Analogue modulation techniques and their implementation: amplitude and angle modulation, Frequency Division Multiplexing. Digitization of analogue signals. Binary system. Arithmetic operations on binary numbers. Modulo 2 arithmetic. Pulse code modulation (PCM), sampling, quantization, coding. Delta and differential pulse code modulation. Synchronous and asynchronous, static and dynamic time division multiplexing. Plesio-synchronous digital hierarchy, primary group, secondary group, groups of higher levels. Synchronous digital hierarchy. Multiplexing PDH signals into SDH STM-1 transport module. Transmission media. Optical fibres: single mode, multimode. Optical cables. Wavelength division multiplexing (WDM): Dense wavelength division multiplexing (DWDM).

EEE 304: Sensors and Actuators,
(2 Units; Core; L = 30; P = 30)

Course Contents
Fundamental Sensor Concepts: Sensor characteristics: transfer function, range and sensitivity, errors and calibration, accuracy and precision, linearity, hysteresis.

Sensors for position, displacement, level and flow, occupancy, sensors for velocity, acceleration, force and strain. Sensors for radiation: sources, detectors, optical circuit components, sensors for temperature: reference points, thermos resistive and thermoelectric sensors.
Sensor interfaces: bridge circuits; capacitance–to-voltage and light-to-voltage converters
Sensing electronic circuits: input characteristics, excitation circuits, overview of amplifiers, amplifier noise (mechanisms, noise figure, noise model).

i. **Electrical Actuators:** Review of Electrical Motors and their types, Motor Equations, Drivers, and Control of DC Motors and Stepper Motors.

ii. **Hydraulic Actuators:** Pumps and its different types, Hydraulic Motors and its different types, Valves and its different types. Cylinders, Accumulators, Intensifiers, Lifts, Couplings, Torque Converters. Hydraulic Circuit Design and Analysis.

iii. **Pneumatic Actuators:** Compressors, fluid conditioners, Pneumatic cylinders, Valves and Plugs, Basic Pneumatic Circuit Design & Analysis, Accumulator system Analysis.

iv. **Translational mechanics:** circuit analogies, transducers and energy harvesting.

Level 400 Courses Contents

TEL 401: Advanced Renewable Energy Systems
(2 Units E: LH 30)

Course Contents
Energy and civilization, Fossil fuels: availability and depletion, Nuclear Energy, Global Warming, Green and Renewable Energy Sources. Estimates of energy costs, components of electric grid, electric energy outlook in Nigeria. Distribution and generation technologies and economics. Fundamentals of Solar Power Systems Photovoltaic Power Conversion, Photovoltaic Material, Modelling of Photovoltaic Systems, Design of Photovoltaic Systems, Concentrated Solar Power. Fundamentals of wind power systems, wind power conversion, modelling of wind power systems, design of wind systems. Hydrogen energy; energy storage and other renewable energy sources. Integration of distribution and generation into the grid dc/ac inverters, analysis of dc/ac inverter dc/dc converters, design of converters for grid operation. Impact of distribution and generation on power system operation, voltage variations circuit, overloading system protection, ride through and fault mitigation, power quality disturbances.

TEL402: Software Applications in Electrical Engineering
(2 Units E: LH 15 PH 45)

Course Contents
The course consists of three blocks, each consisting of a project assignment, lectures and exercise sessions:

Block 1 includes analysis and modelling of the need for Information exchange for power system control. The aim is to train the students to analyse different perspectives on information necessary for power system control. The project assignment in the block includes implementation of a simple information model for the exchange of data on power systems.

Block 2 includes basics in programming techniques and computer science focusing on machine learning methods with applications in power systems. The project assignment in the block consists of developing machine learning algorithms for forecasting.

Block 3 includes; Introduction to matlab: Laboratory oriented course designed to introduce students who already have taken a programming course to programming in MATLAB. Topics include introduction to the MATLAB environment, matrix manipulation and computation, MATLAB programming language, writing functions and scripts, and production of 2D graphical output.

TEL 421: Control Engineering
(2 Units E: LH 30)

Course Contents
Feedback concept, advantages, system classification, structures; Control system components - mechanical, electronic hydraulic, thermal, position control; Transient analysis of servo-mechanism, signal regulators compensation techniques;

Series/parallel feedback controllers. System transfer functions, signal flow graphs, stability, Routh-Hurwitz criteria.

TEL 423: Power Electronics
(2 Units E: LH 30)

Course Contents
The basics of three-phase circuits, connections, voltage and current analysis and 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) and their power switching and control methods; the methods of circuit analysis applicable to switched mode circuits; essential properties of the relevant semiconductor devices; simple converters for practical applications.

Topics: Characteristics of power devices; DC-DC converters; AC Current, Voltage and Power; Effects of power electronics on AC power Rectifiers (AC-DC converters) and Inverters (DC-AC converters).

GET 499: Students Industrial Work Experience III
(8 Units C: 24 weeks)

Course Contents
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 of 400-Level to the beginning of the first semester of the next session. Thus, the

whole of the second semester of 400-Level is spent in industrial attachment). 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 an 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 401 Artificial Intelligence and Applications,
(2 Units; Core; L = 30; P = 30)

Course Contents

i. **Introduction to Artificial Intelligence:** Overview of AI, history, and applications.

ii. **Machine Learning:** Supervised and unsupervised learning, decision trees, neural networks, and deep learning.

iii. **Natural Language Processing:** Text processing, sentiment analysis, and chatbots.

iv. **AI in Robotics:** Robot kinematics, dynamics, and control.

v. **AI Applications:** Healthcare, finance, transportation, and other domains.

vi. **AI Ethics:** Ethical and social issues related to AI development and deployment.

EEE 402 Integrated Systems Design Project
(3 Units; Core; L 30; P 45)

Course Contents
There will be numbers of class room lectures (within 3-5 weeks) on cost analysis, reliability of systems and how to make good power point slides and technical report. Guidance by supervisor and lab technologist. Group presentation and technical report and student participation will comprise the 100% assessment of the course.

EEE 403 AC Machines
(3 Units; Core; L = 30; P = 45)

Course Contents
i. **Polyphase Induction Machine:** Determination of circuit model parameters. Phasor diagram. Circuit diagram. Motor performance in the steady-state. Power factor adjustment. Brief discussion of the effect of harmonics (cogging, crawling, noise and additional loss). Unbalanced operation. Induction generators.

ii. **Single-phase induction Motors:** Circuit model of single-phase induction motors. Performance calculation and characteristics: split phase motor, capacitor start motor, permanent capacitor motor, shaded-pole motor, universal motor, repulsion motor and linear motor.

iii. **Synchronous Machines:** Operation of salient pole machine. Synchronous machine on infinite busbar (cylindrical and salient poles types). Paralleling of polyphase synchronous machines (synchronization). Parallel operation of generators. Open-circuit and short-circuit characteristics. Measurement of synchronous reactance. Short-circuit ratio. Calculating excitation requirements for given operating point conditions. Potier triangle method of measuring leakage reactance. The capability curves. Voltage regulation of generators.

iv. **AC Machine control:** Starting and breaking speed control. Faults and protection.

Level 500 Courses Contents

GET 501: Engineering Project Management
(3 Units C: LH 45)

Course Contents

Project management fundamentals: – definitions of concept 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 the 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 502: Engineering Law
(2 Units C: LH 30)

Course Contents
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.

TEL 502: Electrical Services Design
(2 Units: C: LH 30)

Course Contents
Basic Electrical Installations; Distribution system, regulations IEE, NEC, Nigeria standards; Illumination, Cables types, ratings, wirings system, earth protection; Auxilliary electrical systems fire alarm, telephone, elevator circuits, proposals, contract document preparation; Design of electrical installations domestic, industrial, commercial air conditioning.

TEL 507: Electric Power Systems Engineering
(2 Units C: LH 30)

Course Contents
Basic single-phase modeling. Three phase system analysis. Three phase models of transmission lines. Three phase models of transformers. Formation of the system admittance matrix. Modeling of Static AC-DC Conversion Plant: Introduction. Rectification, inversion. Communication reactance. DC transmission. Load Flow: Introduction, Basic nodal-method. Conditioning of Y matrix. The case where one voltage is known. Analytical definition of the problem. Newton-Raphson method of solving load flow problem. Techniques that make Newton-Raphson Me Basic single-phase modeling. Three-phase system analysis. Three-phase models of transmission lines. Three-phase models of transformers. Formation of the system admittance matrix. Modeling of Static AC-DC Conversion Plant: Introduction. Rectification, inversion. Communication reactance. DC transmission. Load Flow: Introduction, Basic nodal-method. Conditioning of Y matrix. The case where one

voltage is known. Analytical definition of the problem. Newton-Raphson method of solving load flow problem. Techniques that make Newton-Raphson Method competitive in load flow. Characteristics of the Newton-Raphson load flow method. Decoupled Newton load flow method. Fast Decoupled load flow. Convergence criteria and tests. Numerical examples. AC-DC Load Flow: Introduction. Formulation of the problem. DC system model. Solution techniques. Control of converter AC terminal voltage. Extension to multiple and or multi-terminal DC systems. DC convergence tolerance. Test system and results Numerical examples. Optimal operating strategies: Scheduling of generation, types generating stations and their tecno-economic operating characteristics Fault analysis and Control strategy: types of system protection, generators, transformers, lines etc. protection schemes switchgear and circuit breakers operating principles and types.

TEL 503: Energy Economy
(2 Units C: LH 30)

Course Contents
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 it also examines energy tax, price regulation, deregulation, energy efficiency and policies for controlling emission.

EEE 501: Analog Electronics Laboratory,
(3 Units; Core; L 30; P 45)

Course Contents

i. **Components:** Resistors and capacitors standard values, Component symbols, Frequency response, bode plots, basics review.
ii. **Diodes:** Diodes, diode equation, Graphical/Load line analysis, Diode models- Ideal, Piecewise linear, AC, Other diode types, Zener diodes, Diode applications- Peak sample, power rectifier, clamps, regulator.

iii. **Bipolar transistors:** Definitions, V-I characteristics, breakdown, Common-emitter large signal model, graphical analysis, Common-collector, Common-emitter, Applications: current source, DC power supply regulator, Bipolar transistors, Transistor biasing, Hybrid-pi equivalent circuit, High-frequency hybrid-pi, H-parameters, Common-emitter amplifier, AC load line, Common-collector (emitter-follower) amplifier, Junction field-effect transistors.

iv. **Operational amplifiers:** Overview, Basic linear op-amp circuits, Inverting, non-inverting, addition, subtraction, amplifiers, inverting, and non-inverting, Cascading; Ideal impedances, I-V conv, V-I conv, difference amp, instrument amp, Integrator, differentiator, Lossy integrator, Negative feedback.

v. **Operational amplifiers:** Limitations, Effect of finite open-loop gain, Differential and common mode input voltage

limits, Common-mode rejection ration, Input resistance, Input bias current, input offset current, Non-zero output resistance, Frequency response, gain-bandwidth product, Output voltage swing, saturation, Output current limit, Compensation, Slew rate, Offset voltage and drift, Op-amp selection considerations, Non-linear op-amp circuits, Precision ½ wave rectifier, log and antilog amps, Comparator, Schmitt-trigger, Schmitt-trigger oscillator (astable multivibrator), 555 IC timer.

EEE 502: Power Electronics Laboratory,
(3 Units; Core; L = 30; P = 45)

Course Contents
Devices include the construction of drive circuitry for an electric go-cart, computer power supplies, three-phase inverters for AC motors, intelligent bulk and boost converters. Basic electric machines introduced include DC, induction, and permanent magnet motors, with drive considerations.

EEE 503: Electric Drives
(2 Units; Core; L = 30; P = 30)

Course Contents
Basis of machine speed control. Nominal speed range and smoothness of speed control. Stability of operation and economic justification. *Speed control of DC Machines:* Braking of DC motor. Shunt field rheostat control. Armature circuit resistance control. Armature terminal voltage control. The Ward-Leonard system. *Thyristors DC Machines Control:*

Control of DC motors using thyristors three phase types. DC-DC or chopper control of DC motors. Microprocessor control. *Control of Induction Motors:* pole-changing method, pole amplitude modulation. Controlling speed by frequency, line voltage control. *Control of Synchronous Machines:* Starting methods. *Thyristors AC Machines Control:* Variable frequency AC motor drive systems. Control with DC-Link converters. Flip power recovery. Variable frequency synchronous motor drives.

EEE 504: Final Year Project
(6 Units C: LH 270 PH)

Course Contents
Individual student or group of students' are to undertake projects to deepen their knowledge, to strengthen their practical experience and to 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 engineering degree.

Elective Course Contents
A student is required to select and register any two of the available elective courses. These can be taken from the elective courses in the Computer and/or Electrical Engineering.

MECHATRONICS ENGINEERING PROGRAMME

This section contains the course summary and course contents for the Level 300 to Level 500 of the B.Eng. Mechatronics Engineering programme. The summary of Level 100 and Level 200 courses and their respective contents can be found in the Foundation Courses section. The complete list of all the courses offered at various levels of B.Eng. Mechatronics Engineering programme can be found in the Glossary.

Mechatronics Engineering Global Course Structure

Level	General Studies	Basic Science	Faculty GET	Programme (CPE)	SIWES*	KHAIRUN	Total Units
100	4	16	3	2	-	8	33
200	4	-	25	3	3	7	42
300	4	-	18	2	4	10	38
400	-	-	-	10	8	11	29
500	-	-	5	8	-	20	33
Total	**12**	**16**	**51**	**25**	**15**	**56**	**175**

Level 300 Mechatronics Engineering Course Summary

Course Code	Course Title	Units	Status	LH	PH
GST 312	Peace and Conflict Resolution	2	C	45	-
ENT 312	Venture Creation	2	C	15	45
GET 301	Engineering Mathematics III	3	C	30	-
GET 302	Engineering Mathematics IV	3	C	45	-
GET 304	Technical Writing and Communication (including Seminar Presentation Skills)	3	C	45	-
GET 305	Engineering Statistics and Data Analytics	3	C	45	-
GET 306	Renewable Energy Systems and Technology	3	C	30	45
GET 307	Introduction to AI, ML and Convergent Technologies	3	C	45	-
c	Design of Mechatronics and Robotics Systems I	2	C	30	-
GET308	Engineering Economics	3	C	45	
MCE301	Control Engineering Fundamentals	3	C	45	45
MCE302	Digital Electronics	2	C	30	

Course Code	Course Title	Units	Status	LH	PH
MCE303	Electrical Circuits Analysis	2	C	30	45
	Total =	**34**			

* To be credited at the 2nd Semester of Level 400.

Course Code	Course Title	Units	Status	LH	PH
GET 399	SIWES II	4	C	12 Wks	

Level 400 Mechatronics Engineering Course Summary

Course Code	Course Title	Units	Status	LH	PH
MCE 401	Computer Vision and Image Processing	2	E	30	-
MCE 403	Microcontroller and Embedded Systems	2	E	30	-
MCE 405	Control Engineering	2	E	15	45
MCE 407	Industrial Automation and Control	2	E	30	-
MCE 409	Sensors and Actuators	2	E	30	-
MCE401	Design of Machine Elements	2	C	30	-
MCE403	Discrete Control Systems	2	C	30	45
MCE405	Electromechanical Devices	3	C	45	
MCE407	Measurements and Instrumentation	2	C	30	45
MCE409	Group Project	2	C		30
	Total =	**21**			

***SIWES Courses**

Course Code	Course Title	Units	Status	LH/PH
GET 299	SIWES I: SWEP	3	C	9 weeks
GET 399	SIWES II	4	C	12 weeks
GET 499	SIWES III	8	C	24 weeks
	Total =	**15**		

*** All credited at the 2nd Semester of 400-Level.**

Level 500 Mechatronics Engineering Course Summary

Course Code	Course Title	Units	Status	LH	PH
GET 501	Engineering Project Management	3	C	45	-
GET 502	Engineering Law	2	C	30	-
MCE 501	Design of Mechatronics & Robotics Systems II	2	E	-	90
MCE 590	Final Year Project	6	C	-	270
MCE 501	Mechanical Vibration	2	C	30	
MCE 502	Reliability and Fault Detection	2	C	30	
MCE 503	Linear Multivariable Control	2	C	30	
MCE 504	Mobile Robotics	2	E	30	
MCE 505	Autonomous Vehicle Guidance Systems	2	E	30	
MCE 506	Computer Software Engineering	2	E	30	
MCE 507	Introduction to VLSI Design Concept	2	E	30	45
MCE 508	Micro-Electro-Mechanical Systems (MEMS) for	2	E	30	45

Course Code	Course Title	Units	Status	LH	PH
	Mechatronics				
MCE 509	Digital Signal Processing	2	E	30	45
MCE 510	Electric Drives	2	E	30	
	Total =	**33**			

Elective Courses

A student is required to select and register any two of the available elective courses. These can be taken from the elective courses in the Computer and/or Electrical Engineering.

Level 300 Course Contents

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

Course Contents
The concepts of peace and the concept of conflict and security in a multi-ethnic nation. Types and theories of conflicts: ethnic, religious, economic, social 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, herders/farmers conflict, economic inequalities, social disputes. Nationalist movements and agitations. Selected conflicts case studies – Tiv-Junkun, Ife/Modakeke, Aguleri/Omoleri, Zango Kartaf, Boko Haram and ISWAP, Fulani settlers/Native Birom, chieftaincy and land disputes, etc. Peace building, management of conflicts and security: Peace & Human Development. Approaches to Peace & Conflict Management (religious, government, community leaders, etc.). Elements of peace studies and conflict resolution: Conflict dynamics assessment Scales: Constructive & 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 & 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.

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

Course Contents
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 & 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 & 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, etc. Digital business and e-commerce strategies).

GET 301: Engineering Mathematics III
(3 Units C: LH 45)

Course Contents
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 302: Engineering Mathematics IV
(3 Units C: LH 45)

Course Contents
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 transformations 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 304: Technical Writing and Communication
(3 Units C: LH 45)

Course Contents
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 and structure Fog 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 305: Engineering Statistics and Data Analytics
(3 Units C: LH 45)

Course Contents
Descriptive statistics, frequency distribution, populations and sample, central tendency, variance of 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 306: Renewable Energy Systems and Technology
(3 Units C: LH 30 PH 45)

Course Contents
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; emphasised 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; transesterification 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 307: Introduction to Artificial Intelligence, Machine Learning and Convergent Technologies
(3 Units C: LH 45)

Course Contents
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.

MCE 321: Design of Mechatronics and Robotics Systems I
(2 Units C: LH 30)

Course Contents
Integrated design process of mechatronics systems; components of mechatronics systems, sensors and actuators, fundamental principal of operation for components, strengths and weaknesses, and operational characteristics. The design process; integrated iterative design, sub-systems, component selection and sizing, design considerations, state-of-the-arts and challenges. Design exercises with increasing degrees of complexity. Others are mechatronics design concepts:

integrative design, concepts analogies between electrical and mechanical systems, appreciation of components of mechatronics systems, formulation of design requirements, design exercise and justifications, optimal division into sub systems component, selection and sizing prototype development, appraisal of benefit and cost evolution of mechatronics design and challenges. case studies.

GET 399: Students Industrial Work Experience II
(4 Units C: 12 weeks)

Course Contents
On-the-job experience in industry chosen for practical working experience but not necessarily limited to the student's major courses (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 industries. 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.

a. Introduction to Solid works: software capabilities, design methodologies and applications.

b. Basics part modelling: sketching with Solid Works, building 3D components, using extruded Bose base.

Basic assembly modelling, and solid Works 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 solid works; and

d. technical report writing.

GET 308: Engineering Economics
(3 Units C: LH 45)

Course Contents
The nature and scope of economics. Basic concepts of engineering economy. Interest formulae, discounted cash flow, present worth, equivalent annual growth and rate of return comparisons. Replacement analysis. Breakdown analysis. Benefit cost analysis. Minimum acceptable rate of return. Judging attractiveness of proposed investments.

MCE 302: Digital Electronics
(2 Units; Core; L = 30; P = 45)

Course Contents
Digital systems and their applications, Number systems and codes, Decimal, binary, octal, and hexadecimal number systems, Binary codes (BCD, Gray code, etc.), Boolean algebra and logic gates, Boolean algebra and its laws, Logic gates and their characteristics, Boolean functions and truth tables. Minimization techniques, Karnaugh maps and Boolean algebraic manipulation. Combinational circuits: Combinational logic circuits, Adders, subtractors, multiplexers, demultiplexers, encoders, and decoders. Sequential circuits: Sequential logic circuits, Flip-flops (SR, D, JK, T), registers, and counters. Digital system design: Design of digital systems using basic building blocks, Timing diagrams and state diagrams.

MCE 303: Electrical Circuits Analysis
(2 Units C: LH=30; PH=45)

Course Content
Two-Port Networks: Two port network parameters: z-, y- and h-parameters. Reciprocity relations for reciprocal two-ports. Measurement of the parameters. Transmission (chain) parameters. Cascaded chain parameters. Image impedance for symmetrical two-ports. Characteristic impedance. Sensitivity Analysis. Active Filter Functions: Definition of filters, importance and applications. Basic filters terminologies; pass band, stop band, transition band, roll off, ripples, gain, Q-factor, phase shift, phase delay, group delay. First and second order Low, high, Band pass, Band reject and all pass filters. Realization of electrical circuits: Foster and Causer's methods of synthesis. Discrete components and Op-amp realization of first and second order filters, Sallen and Key Structures. Direct Replacement of Inductances: Problems with inductor, simulated grounded and floating inductor, variation of simulated inductance with frequency. Gyrators; positive impedance inverters, negative impedance converters. Fourier Methods of Analysis: Fourier Transforms and Response of linear networks. Power (or energy) spectra, random signals. Analysis and synthesis of non-linear resistive circuits, harmonic analysis of non-linear dynamic circuits. Time and frequency domain analysis of networks. Application of Fourier series in network analysis.

Laboratory Content
Determination of H parameters, Y parameters, Z parameters and ABCD parameters by shorting the voltage sources and opening

the current sources at the terminals. Implement active low pass, high pass and band pass filters. Determine circuit voltage, transfer function, step response transform and output waveform. Use any simulation software to determine the step response through transient analysis.

Level 400 Course Contents

MCE 401: Computer Vision and Image Processing (2 Units E: PH 30)

Course Contents

Computer vision and image processing are important and fast evolving areas of Mechatronics and Robotics. Student will get familiar with both established and emergent methods, algorithms and architectures. The course will enable students to apply computer vision and image processing techniques to solving various real-world mechatronics and robotics problems, and develop skills for research in the fields. Image formation, image filtering, edge detection and segmentation, morphological processing, registration, object recognition, object detection and tracking 3D vision.

The topics may include but are not limited to:

1. Image formation and perception, image representation.
2. Image filtering: space and frequency, domain filtering, linear and non-linear filters.
3. Morphological image processing.
4. Image geometric transformations, image registration.
5. Edge detection, image segmentation, active contours, and level set methods.
6. Object recognition, template matching, and classification.
7. Object detection and tracking: background modeling, kernel-based tracking, particle filters.
8. Camera models, stereo vision.

MCE 403: Microcontroller and Embedded Systems
(2 Units E: PH 30)

Course Contents

Introduction to embedded systems, history, design challenges, optimizing design metrics, time to market, applications of embedded systems and recent trends in embedded systems, embedded design concepts and definitions, memory management, hardware and software design and testing, communication protocols like SPI, I2C, CAN etc. RISC Design Philosophy, comparison between CISC and RISC; PIC/AVR/ARM Design Philosophy; Embedded System hardware, Embedded System software. PIC/AVR/ARM Processor fundamentals – PIC/AVR/ARM core architecture, data flow model, Register, Current Program Status Register, Pipeline, Exceptions, Interrupts and Vector Table, Core Extensions, PIC/AVR/ARM Processor families. PIC16F18877/ AT mega 328P/ATSAM3X8E Cortex-M3 processors Block diagram and pin diagram, operating modes: Study of on-chip peripherals like I/O ports, timers, counters, interrupts, on-chip ADC, DAC, RTC modules, WDT, PLL, PWM and USB. Hardware interfacing of PIC16F18877/ATmega328P/ATSAM3X8E Cortex-M3 using CCS C Compiler/Flowcode/Embedded C language: LED, Switches, LCD Display & stepper motor. On-chip programming: UART, Timer, Real-Time Clock & ADC. Others include Architecture of kernel, task and task scheduler, ISR, Mutex, Semaphores, mailbox, message queues, pipes, events, timers, Priority inversion problem, priority Inheritance, RTOS services in contrast with traditional OS. Introduction to μcos II RTOS and its features, study of kernel structure of μcos II. A

case study of digital camera and automatic chocolate vending machine (without codes).

MCE 405: Control Engineering
(2 Units E: LH 15; PH 45)

Course Contents

Introduction to control system: Concept of feedback and Automatic control, Effects of feedback, Objectives of control system. Definition of linear and nonlinear systems, Elementary concepts of sensitivity and robustness. Types of control systems, Servomechanisms and regulators, examples of feedback control systems. Transfer function concept. Pole and Zeroes of a transfer function. Properties of Transfer function. Mathematical modelling of dynamic systems. Translational systems, Rotational systems, Mechanical coupling, Liquid level systems, Electrical analogy of Spring– MassDashpot system. Block diagram representation of control systems. Block diagram algebra. Signal flow graph. Mason's gain formula. Control system components: Potentiometer, Synchros, Resolvers, Position encoders. DC and AC tachogenerators. Actuators. Block diagram level description of feedback control systems for position control, speed control of DC motors, temperature control, liquid level control, voltage control of an Alternator.

Time domain analysis: Time domain analysis of a standard second order closed loop system. Concept of undamped natural frequency, damping, overshoot, rise time and settling time. Dependence of time domain performance parameters on natural frequency and damping ratio. Step and Impulse response of first and second order systems. Effects of Pole and Zeros on

transient response. Stability by pole location. Routh Hurwitz criteria and applications. Error Analysis: Steady state errors in control systems due to step, ramp and parabolic inputs. Concepts of system types and error constants. **Stability Analysis:** Root locus techniques, construction of Root Loci for simple systems. Effects of gain on the movement of Pole and Zeros. Frequency domain analysis of linear system: Bode plots, Polar plots, Nichol's chart, Concept of resonance frequency of peak magnification. Nyquist criteria, measure of relative stability, phase and gain margin. Determination of margins in Bode plot. Nichol's chart. circle and Contours in Nichols chart. **Control System performance measures:** Improvement of system performance through compensation. Lead, Lag and Lea lag compensation, PI, PD and PID control.

MCE 407: Industrial Automation and Control
(2 Units E: PH 30)

Course Contents
This course provides an overall exposure to the Technology of Industrial Automation and Control as widely seen in factories of all types, both for discrete and continuous manufacturing. The course covers a wide range of related topics from the advantage and architecture of automation systems, measurement systems, including sensors and signal conditioning, discrete and continuous variable control systems, hydraulic, pneumatic and electric actuators, industrial communication to embedded computing and CNC machines. More specifically, the course covers:

i. Introduction to Industrial Automation and Control, Architecture of Industrial Automation Systems

Measurement Systems: Pressure and Force Measurement, Temperature measurement, Displacement and Speed Measurement, Flow Measurement, Measurement of Level, Humidity and pH, Signal Conditioning Circuits, Errors and Calibrations. **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. **CNC Machines:** Introduction to CNC Machines, CNC Machines Interpolation, Control and Drive. **Actuators:** Control Valves, Directional Control Valves, Switches and Gauges, Industrial Hydraulic Circuits, Pneumatic Control Components, Pneumatic Control Systems,

ii. **Electric Machines Drive:** Energy Savings with Variable Speed Drives, Step Motors - Principles, Construction and Drives, DC Motors Drives, Induction Motor Drives, BLDC Motor Drives. **Industrial Embedded and Communication System:** Introduction to Real-time Embedded Systems, Real-Time Operating Systems, Networking of Field Devices via Fieldbus, Higher Levels of Industrial Automation.

MCE 409: Sensor and Actuators
(2 Units E: LH 30)

Course Contents
This course provides an introduction to sensors and actuators in mechatronics systems. The topics include, sensing principles for measuring motion, force, torque, pressure, flow, and temperature using analogue and digital transducers; actuating principles for continuous drive actuators and stepper motors; power transmission systems; and methods for signal collection, conditioning and analysis. Various components will be experimentally tested and analysed. Others are the basics of Energy Transformation: Transducers, Sensors and Actuators.

Understanding of Sensor Interfacing with Microprocessor to build electronic system Week 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. Actuator performance criteria and selection, including: (a) Fluidic actuators (b) Solenoids and voice coil motors (c) Stepper motors (d) DC motors (e) Piezoelectric actuators (f) Shape memory alloy actuators (g) MEMS sensors and actuators. Merits of Fluid power & its utility for increasing productivity through Low-Cost Automation, Transmission of Fluid Power through various types of Cylinders), Symbolic representation of Pneumatic elements (CETOP), Compressors and Air supply system including airline installations, Signalling & control system. Introduction to Industrial Hydraulics, Hydraulics Power System

elements and standard symbolic Representation (CETOP symbols). Pneumatic & hydraulic control elements (control valves & hydraulic pumps, accessories), Basic circuits for controlling single & double-acting cylinder, Basic circuits, Advantages of Hydro-Pneumatics and its applications, Hydraulics system and their Classification. Hydraulics circuits Hydraulic Motors, Hydraulic Fluids and effective contamination control. Advanced pneumatic circuits for controlling multi-cylinders (operable inoperable circuits), Electro pneumatics with relay logic, Pneumatics system with PID controls, Application of fluidics a non-moving part logic.

GET 499: Students Industrial Work Experience III
(8 Units C: 24 weeks)

Course Contents
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 next session. Thus, the second semester at 400-Level is spent in industry for industrial attachment). 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 an 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 that covers the whole of the student's industrial training experiences (GET 299, GET 399 and GET

499), and on which a seminar will be presented to the Department for overall assessment.

MCE 401: Design of Machine Elements
(2 Units C: LH=30)

Course Content
Introduction to components design processes. Analysis and design of individual machine components (shafts, belts, chain drives, clutches, bearing keys, keyways, and gears).

MCE403: Discrete Control Systems
(2 Units C: LH=30; PH=45)

Course Content
Digital computers in control loops. Discrete-time and digital control systems. Sampling process and theorem. Shannon's sampling theorem. Data reconstruction. *Z*-transform. Inverse *z*-transform. Linear difference equations and their solutions using *z*-transforms. Relationship between s-plane and z-plane. Discrete system time responses and steady state error analysis. Stability in the *z*-plane. Discrete PID controller realisation. Microcontroller implementation of discrete control systems.

Laboratory Content
a. Design and simulate discrete PID controllers using MATLAB/Simulink.
b. Implement discrete PID controllers on microcontrollers.
c. Tune and analyse the performance of discrete PID controllers.

d. Implement discrete time FIR and IIR filters.

MCE 405: Electromechanical Devices
(3 Units C: LH=45; PH=45)

Course Contents
Magnetic Circuits: magnetic fields, flux, materials, hysteresis, dc and ac operation of magnetic circuits, self and mutual inductance, equivalent circuits. Transformers: principle of operation, equivalent circuits, three-phase connections, autotransformers. Fundamentals of Rotating Machines: basic concepts, armature mmf, rotating mmf, generated voltage, torque. DC Machines: Faraday's Law, performance equations, armature reaction, generator and motor characteristics, losses and efficiency, equivalent circuits. Synchronous Machines: magnetomotive forces and fluxes, synchronous speed, generator and motor characteristics, losses and efficiency, equivalent circuits. Induction Motors: slip, performance calculations, equivalent circuits, speed control, starting techniques.

MCE 407: Measurements and Instrumentation
(2 Units C: LH=30; PH=45)

Course Content
Measurement Methods: Analogue techniques, comparison techniques, substitution methods, null methods. Input Characteristics- sensitivity, scaling, and matching. Accuracy: Values and uncertainty, precision, errors, summation of errors, random errors. Specifications and standards. Calibration Procedures. Wave-forms: Sine wave, mean value, RMS value, Form Factor and crest factor, phase relationships, Bias,

Harmonics, Frequency Effects, Bandwidth, Rise time. Interference: Environmental and coupled. Analogue Instruments: Moving coil instruments, electro-dynamic instrument. Other pointer instruments. Energy meters. Oscilloscope, comparison methods-DC and AC potentiometers, DC and AC Bridges. Digital Instruments: Counters. Multi-function digital voltmeters. DACs and ADCs. Sample and hold circuits. Wave analyzers. Transducers: Classification, types, and characteristics. Conversion of signals into electrical variables.

KHAIRUN-MCE 409 Group Project
(2 Units C: PH 30)

Level 500 Courses Contents

GET 501: Engineering Project Management
(3 Units C: LH 45)

Course Contents

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 502: Engineering Law
(2 Units C: LH 30)

Course Contents
Common Law: The history of common law; definition, The nature and division of Common Law; Legislation; codification interpretation; Equity: definition and the main spheres of equity. Law of contracts for Engineers; Forms of contract and criteria for selecting contractors; offer, acceptance; communication of the 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.

MCE 501: Design of Mechatronics and Robotics Systems II
(2 Units C: PH 90)

Course Contents
This is essentially the practical implementation of the content of MCE 321, with students working independently and in focus groups. See content of MCE 321 for more details.

MCE 599: B.Eng Project
(6 Units C: LH 270)

Course Contents
Each student must undertake a project under the supervision of a lecturer, submit a comprehensive project report and present a seminar at the end of the year. A project status report is to be presented at the end of the first semester. Each student must attend Engineering Seminars. This course lasts for only one academic session.

MCE 501: Mechanical Vibrations
(2 Units C: LH=30)

Course content
Mechanical Vibration: Introduction, Degrees of Freedom. Vibrations of Linear System with one degree of Freedom: Undamped free and forced vibration, Damping (viscous), Damped free and forced vibration, Vibration isolation and transmitted force, The centrifugal pendulum, Torsional damped vibration at critical speed. Vibration of Linear System with Two or More degrees of Freedom: Equations of motion and solution. Undamped free and forced vibrations. Dynamic vibration absorber. Transmission of

force and motion. Torsional Vibration: Discrete systems. Undamped free and forced torsional vibration. Oscillation of geared systems. Transverse Vibration: Natural frequency of distributed system in transverse vibration whirling shafts. Exact and approximate method. Introduction to nonlinear Vibrations.

MCE 502: Reliability and Fault Detection
(2 Units C: LH=30)

Course Content
Basic theory of reliability and faults: Introduction to reliability, maintainability, availability and safety. Elementary reliability theory. Applications to mechatronics components. Faults, failures or malfunctions. Fault tolerant systems. Fault detection: Causes of faults. Common fault types. Fault detection techniques. Fault diagnosis: Fault diagnosis elements. Fault diagnosis methods. Challenges of fault diagnosis. Fault tolerance: Common methods of fault tolerance. Redundancy. Reconfiguration

MCE 503: Linear Multivariable Control
(2 Units C: LH=30)

Course Content
Definition of state. Importance of state space analysis. State Space description of linear systems. Canonical forms. Time domain solutions of state equations. Conversion from transfer functions to state space. Conversion from state space to transfer function representation. Linearization of nonlinear systems. Concepts of controllability and observability. Definition of the state feedback control. Pole placement controller. Pole

selections. Linear Quadratic Regulator (LQR) control. Stability in the sense of Lyapunov.

MCE 504: Mobile Robotics
(2 Units E: LH=30)

Course Content
Behaviour based Robotics: Whence behaviour, Animal behaviour, Robot behavior. Behaviour-based architectures; architectural issues in behaviour-based approaches. Intelligent Mobile Robots: Theory of Voting Technique, Mobile Robot with Dynamic Weighted Voting Technique, Goal-Directed Navigation, Intelligent Multi-Agent Robotic Systems. Sensor Fusion: Introduction to Sensor Fusion, Sensors and use of Multiple Sensors, Techniques of Sensor Fusion: Bayesian Approach, Dempster-Shafer, Histogrammic in Motion Mapping.

MCE 505: Autonomous Vehicle Guidance Systems
(2 Units E: LH=30)

Course Content
Navigation and guidance systems. Path planning for Unmanned Ground Vehicles (UGVs) and Unmanned Aerial Vehicles (UAVs). Guidance systems. Guidance approaches: Proportional Navigation. Geometric guidance. Path planning and following. Optimal guidance. Navigation approaches: Navigation systems. Global Navigation Satellite System. Terrain based navigation. SLAM (Simultaneous Localisation and Mapping). Cooperative guidance and collision avoidance.

MCE 506: Computer Software Engineering
(2 Units, E: LH=30)

Course Contents
Introduction to computer software fundamentals. Number representation. Data structure and algorithms. Abstract, modules, inheritance, models and objects. Designing for efficiency, reliability and reusability. Object oriented software design. Object oriented programming.

Software implementation and testing. Team software specification and management. Cross-platform tools and GUI development. Advance software algorithms and architecture.
Software practice and methods

MCE 507: Introduction VLSI Design Concept
(2 Units; E; L = 15; P = 30)

Course contents
Overview of VLSI Technology. Automatic chip layout. Analog circuit simulation for digital circuit design. Structured design methodologies. CMOS Processing Technology. Logic gate, MUX, and D flip-flop design. VLSI Design Flow. MOS Layers Stick diagram. Design rules and Layout generation. MIPS Microprocessor example. MOS Transistor Theory and Models for Resistance and Capacitance calculation. Logical Effort. Combinational circuits and CMOS logic families. Sequential circuits and layout. Analog simulation and Adder design. Data path design and SRAM design. VLSI circuit testing. VLSI circuit built-in self-testing. Boundary scan standard and circuit reliability. Power estimation and chip packaging. Pads and scaling. Case study of Intel microprocessors.

MCE 508: Micro-Electro-Mechanical Systems (MEMS) for Mechatronics
(2 Units; E; LH = 30; PH = 45)

Course content
Overview of MEMS technology. History of MEMS technology. Miniaturization. Scaling in Geometry. Scaling in Rigid-Body Dynamics. Scaling in Electro Static Forces. Scaling in Electro Magnetic Forces. Scaling in Electricity. Scaling in Fluid Mechanics. Scaling in Heat Transfer. Working Principle of MEMS. MEMS Micro Sensors and Micro Actuators. Materials used in MEMS Fabrication. Microfabrication using lithography. Ion implantation. Diffusion. Oxidation. Chemical vapour deposition. Physical vapour deposition (Sputtering). Deposition by epitaxy. Etching. Fabrication using Bulk Micro-manufacturing. Surface Micro-manufacturing. LIGA Process. Design and simulation using FEM tools. Applications.

MCE 509: Digital Signal Processing
(2 Units; E; LH = 30)

Course Content
Introduction to signals and systems: Continuous-Time signals, Continuous-Time Convolution, Linear Time-Invariant Systems, and Properties of LTI Systems.

Discrete-Time Signals: Sampling Theory, Linear Systems, Discrete signals (impulse, step, exponential), Discrete-Time Convolution, Fourier-Transform; DFT and FFT.

Digital Filters: Advantages and disadvantages over analogue filters. Binomial transformation, FIR and IIR digital filters design.

Applications of DSP: STFT, speech; 2D signal processing-image filtering deconvolution; communication systems.

Laboratory Content

1. Design, and analysis of digital filters using MATLAB software package.
2. Implement a project on the application of signal processing

MCE 510: Electric Drives,
(2 Units; E; LH = 30; PH = 45)

Course Contents

Basis of machine speed control. Nominal speed range and smoothness of speed control. Stability of operation and economic justification. Speed control of DC Machines: Braking of DC motor. Shunt field rheostat control. Armature circuit resistance control. Armature terminal voltage control. The Ward-Leonard system. Thyristors DC Machines Control: Control of DC motors using thyristors three phase types. DC-DC or chopper control of DC motors. Microprocessor control. Control of induction Motors: pole-changing method, pole amplitude modulation. Controlling speed by frequency, line voltage control. Control of Synchronous Machines: Starting methods. Thyristors AC machines Control: Variable frequency AC motor drive systems. Control with DC-Link converters. Flip power recovery. Variable frequency synchronous motor drives.

Elective Course Contents

These can be taken from the elective courses in the Computer and/or Electrical Engineering.

APPENDIX

This Appendix contains the list of all the courses offered in each programme, from the first year to the final year (i.e. Level 100 to Level 500).

B.ENG. COMPUTER ENGINEERING PROGRAMME COURSES

LEVEL 100 COURSES

Course Code	Course Title	Units	Status	LH	PH
CPE 112	Introduction to Computer Engineering	2	C	30	-
GET 101	Engineer in Society	1	C	15	-

Course Code	Course Title	Units	Status	LH	PH
GET 102	Engineering Graphics and Solid Modelling I	2	C	15	45
GST 111	Communication in English	2	C	15	45
GST 112	Nigerian Peoples and Culture	2	C	30	-
MTH 101	Elementary Mathematics I: Algebra and Trig.	2	C	30	-
MTH 102	Elementary Mathematics II: Calculus	2	C	30	-
PHY 101	General Physics I: Mechanics	2	C	30	-
PHY 102	General Physics II: Behaviour of Matter	2	C	30	-
PHY 107	General Practical Physics I	1	C	-	45
PHY 108	General Practical Physics II	1	C	-	45
CHM101	General Chemistry I	2	C	30	-
CHM102	General Chemistry II	2	C	30	-
CHM107	General Practical Chemistry I	1	C	-	45
CHM108	General Practical Chemistry II	1	C	-	45
MCE104	Introduction to Python Programming	2	C	45	-

Course Code	Course Title	Units	Status	LH	PH
MTH104	Elementary Maths III (Vectors, Matrix, Geom)	3	C	45	-
MTH105	Basic Statistics	3	C	45	-
PHY104	General Physics III (Electricity & Magnetism)	2	C	30	15

LEVEL 200 COURSES

Course Code	Course Title	Units	Status	LH	PH
EEE208	Electrical Engineering Materials	3	C	45	-
GET 201	Applied Electricity I	3	C	45	-
GET 202	Engineering Materials	3	C	45	-
GET 203	Engineering Graphics and Solid Modeling II	2	C	15	45
GET 204	Students Workshop Practice	2	C	15	45
GET 205	Fundamentals of Fluid Mechanics	2	C	30	-
GET 206	Fundamentals of Thermodynamics	3	C	45	-
GET 207	Applied Mechanics	3	C	45	-
GET 208	Strength of Materials	3	C	45	-
GET 209	Engineering Mathematics I	3	C	45	-
GET 210	Engineering Mathematics II	3	C	45	-
GET 211	Computing and Software Engineering	3	C	30	45
GET 299	SIWES I: Students Work Experience Scheme	3	C	-	9wks

Course Code	Course Title	Units	Status	LH	PH
GST 211	Entrepreneurship and Innovation	2	C	30	-
GST 212	Philosophy, Logic and Human Existence	2	C	30	-
CPE201	Introduction to Signal Processing	3	C	30	45
CPE202	Introduction to Machine Learning	3	C	45	-
MCE202	Dynamics	2	C	30	-

COMPUTER - LEVEL 300 COURSES

Course Code	Course Title	Units	Status	LH	PH
CPE 301	Computer Organisation and Architecture	2	C	30	-
CPE 302	Measurement and Instrumentation	3	E	30	45
EEE 321	Analogue Electronic Circuits	2	E	15	45
EEE 322	Digital Electronic Circuits	2	E	30	
ENT 312	Venture Creation	2	C	15	45
GET 301	Engineering Mathematics III	3	C	45	-
GET 302	Engineering Mathematics IV	3	C	45	-
GET 304	Engineering Communication, Technical Writing and Presentation	3	C	45	-
GET 305	Engineering Statistics and Data Analytics	3	C	45	-
GET 306	Renewable Energy Systems and Technologies	3	C	30	45
GET399	SIWES II	4	C	-	12wks
GST 312	Peace and Conflict Resolution	2	C	30	-
CPE 301	System Modelling and Analysis	3	C	30	45

Course Code	Course Title	Units	Status	LH	PH
CPE 302	Communications Principles	2	C	30	15
CPE 303	Sensors and Actuators	2	C	30	15
CPE 304	Database Programming	3	C	30	45
CPE 305	Introduction to Image Processing	3	C	30	45

COMPUTER - LEVEL 400 COURSES

Course Code	Course Title	Units	Status	LH	PH
CPE 401	Microprocessor and Embedded Systems	3	C	30	45
CPE 403	Control System	2	C	30	-
CPE 405	Fundamentals of Software Engineering	2	C	30	-
CPE 411	Hardware Design Techniques and Verification	2	E	30	-
CPE 413	Research Methods	2	E	30	-
GET 499	SIWES III	8	C	-	24wks
CPE 401	Introduction to Digital Communications	2	C	30	15

COMPUTER - LEVEL 500 COURSES

Course Code	Course Title	Units	Status	LH	PH
GET 501	Engineering Project Management	3	C	45	-
GET 502	Engineering Law	2	C	30	-
CPE 501	Testing, Reliability and Maintainability	2	C	30	-
CPE 502	Digital Signal Processing	3	C	45	-
CPE 511	Machine Learning and Applications	3	C	45	-
GET 599	Final Year Project	6	C	-	270
CPE 501	Introduction to Computer Vision	2	C	30	15
CPE 502	Computer Network Security	2	C	30	-
CPE 503	Cryptography & Crypto Analysis	2	E	30	-

COMPUTER - ELECTIVE COURSES

Course Code	Course Title	Units	Status	LH	PH
CPE 505	Digital System Design with VHDL	2	E	30	-
CPE 514	Professional Practice and Ethics	2	E	30	-
CPE 516	Nanoelectronics and Computing System	2	E	30	-
CPE 517	Image Processing	2	E	30	-
CPE 518	Advanced Web Technologies	2	E	30	-
CPE 519	Embedded Systems	2	E	30	-

B.ENG. ELECTRICAL ENGINEERING PROGRAMME COURSES

LEVEL 100 COURSES

Course Code	Course Title	Units	Status	LH	PH
GET 101	Engineer in Society	1	C	15	-
GET 102	Engineering Graphics and Solid Modelling I	2	C	15	45
GST 111	Communication in English	2	C	15	45
GST 112	Nigerian Peoples and Culture	2	C	30	-
MTH 101	Elementary Mathematics I: Algebra and Trig.	2	C	30	-
MTH 102	Elementary Mathematics II: Calculus	2	C	30	-
PHY 101	General Physics I: Mechanics	2	C	30	-
PHY 102	General Physics II: Behaviour of Matter	2	C	30	-
PHY 107	General Practical Physics I	1	C	-	45
PHY 108	General Practical Physics II	1	C	-	45
TEL 100	Introduction to Electrical Engineering	2	C	30	-

CHM101	General Chemistry I	2	C	30	-
CHM102	General Chemistry II	2	C	30	-
CHM107	General Practical Chemistry I	1	C	-	45
CHM108	General Practical Chemistry II	1	C	-	45
MCE104	Introduction to Python Programming	2	C	45	-
MTH104	Elementary Maths III (Vectors, Matrix, Geom)	3	C	45	-
MTH105	Basic Statistics	3	C	45	-
PHY104	General Physics III (Electricity & Magnetism)	2	C	30	15

LEVEL 200 COURSES

Course Code	Course Title	Units	Status	LH	PH
EEE208	Electrical Engineering Materials	3	C	45	-
GET 201	Applied Electricity I	3	C	45	-
GET 203	Engineering Graphics and Solid Modeling II	2	C	15	45
GET 204	Students Workshop Practice	2	C	15	45
GET 206	Fundamentals of Thermodynamics	3	C	45	-
GET 207	Applied Mechanics	3	C	45	-
GET 209	Engineering Mathematics I	3	C	45	-
GET 210	Engineering Mathematics II	3	C	45	-
GET 211	Computing and Software Engineering	3	C	30	45
GET 299	SIWES I: Students Work Experience Scheme	3	C	-	9wks
GST 211	Entrepreneurship and Innovation	2	C	30	-
GST 212	Philosophy, Logic and Human Existence	2	C	30	-
EEE201	Introduction to Signal Processing	3	C	30	45

Course Code	Course Title	Units	Status	LH	PH
CPE202	Introduction to Machine Learning	3	C	45	-

ELECTRICAL - LEVEL 300 COURSES

Course Code	Course Title	Units	Status	LH	PH
EEE 321	Analogue Electronic Circuits	2	C	30	-
ENT 312	Venture Creation	2	C	15	45
GET 301	Engineering Mathematics III	3	C	45	-
GET 304	Technical Writing and Communication	3	C	45	-
GET 305	Engineering Statistics and Data Analytics	3	C	45	-
GET 306	Renewable Energy Systems and Technology	3	C	30	45
GET 307	Introduction to AI, ML and Convergent Technologies	3	C	45	-
GET 399	SIWES II: Students Work Experience Scheme	4	C	12 wks	-
GST 312	Peace and Conflict Resolution	2	C	30	-
TEL 303	Electric Circuit Theory	2	C	30	-
TEL 304	Measurements and Instrumentation	2	C	30	-
TEL 305	Electrical Machines	3	C	45	-

Course Code	Course Title	Units	Status	LH	PH
TEL 322	Electrical Energy Systems	2	E	30	-
TEL 324	Electromagnetic Theory	2	E	30	-
EEE 301	System Modelling and Analysis	3	C	30	45
EEE 302	Digital Electronics	2	C	30	15
EEE 303	Communications Principles	2	C	30	15
EEE 304	Sensors and Actuators	2	C	30	15

ELECTRICAL - LEVEL 400 COURSES

Course Code	Course Title	Units	Status	LH	PH
TEL 421	Control Engineering	2	E	30	-
TEL 423	Power Electronics	2	E	30	-
TEL 401	Advanced Renewable Energy Systems	2	E	30	-
TEL 402	Software/Computer Applications in Electrical Engineering	2	E	15	60
GET 499	SIWES III: Students Work Experience Scheme	8	C	24 wks	-
EEE 401	Artificial Intelligence and Applications	2	C	30	15
EEE 402	Integrated Systems Design Project	3	C	30	45
EEE 403	AC Machines	3	C	30	45

ELECTRICAL - LEVEL 500 COURSES

Course Code	Course Title	Units	Status	LH	PH
GET 501	Engineering Project Management	3	C	45	-
GET 502	Engineering Law	2	C	30	-
TEL 502	Electrical Services Design	2	C	30	-
TEL 507	Electric Power Systems Engineering	2	C	30	-
TEL 503	Energy Economy	2	E	30	-
EEE 501	Analog Electronics Laboratory	3	C	30	45
EEE 502	Power Electronics Laboratory	3	C	30	45
EEE 503	Electric Drives	2	C	30	15
EEE 504	Final Year Project	6	C	30	45
	Elective	2	E	30	-
	Elective	2	E	30	-

ELECTRICAL - ELECTIVE COURSES

Course Code	Course Title	Units	Status	LH	PH
TEL 503	Energy Economy	2	E	30	-
CPE 516	Nanoelectronics and Computing System	2	E	30	-

B.ENG. MECHATRONICS ENGINEERING PROGRAMME COURSES

MECHATRONICS - LEVEL 100 COURSES

Course Code	Course Title	Units	Status	LH	PH
GET 101	Engineer in Society	1	C	15	-
GET 102	Engineering Graphics and Solid Modelling I	2	C	15	45
GST 111	Communication in English	2	C	15	45
GST 112	Nigerian Peoples and Culture	2	C	30	-
MTH 101	Elementary Mathematics I: Algebra and Trig.	2	C	30	-
MTH 102	Elementary Mathematics II: Calculus	2	C	30	-
MCE 112	Introduction to Mechatronics Engineering	2	C	30	-
PHY 101	General Physics I: Mechanics	2	C	30	-
PHY 102	General Physics II: Behaviour of Matter	2	C	30	-
PHY 107	General Practical Physics I	1	C	-	45
PHY 108	General Practical Physics II	1	C	-	45

Course Code	Course Title	Units	Status	LH	PH
CHM101	General Chemistry I	2	C	30	-
CHM102	General Chemistry II	2	C	30	-
CHM107	General Practical Chemistry I	1	C	-	45
CHM108	General Practical Chemistry II	1	C	-	45
MCE104	Introduction to Python Programming	2	C	45	-
MTH104	Elementary Maths III (Vectors, Matrix, Geom)	3	C	45	-
MTH105	Basic Statistics	3	C	45	-
PHY104	General Physics III (Electricity & Magnetism)	2	C	30	15

MECHATRONICS – LEVEL 200 COURSES

Course Code	Course Title	Units	Status	LH	PH
GET 201	Applied Electricity I	3	C	45	-
GET 202	Engineering Materials	3	C	45	-
GET 203	Engineering Graphics and Solid Modeling II	2	C	15	45
GET 204	Students Workshop Practice	2	C	15	45
GET 205	Fundamentals of Fluid Mechanics	2	C	30	-
GET 206	Fundamentals of Thermodynamics	3	C	45	-
GET 207	Applied Mechanics	3	C	45	-
GET 208	Strength of Materials	3	C	45	-
GET 209	Engineering Mathematics I	3	C	45	-
GET 210	Engineering Mathematics II	3	C	45	-
GET 211	Computing and Software Engineering	3	C	30	45
GET 299	SIWES I: Students Work Experience Scheme	3	C	-	9wks
GST 211	Entrepreneurship and Innovation	2	C	30	-

Course Code	Course Title	Units	Status	LH	PH
GST 212	Philosophy, Logic and Human Existence	2	C	30	-
MCE202	Dynamics	2	C	30	-

MECHATRONICS - LEVEL 300 COURSES

Course Code	Course Title	Units	Status	LH	PH
GST 312	Peace and Conflict Resolution	2	C	45	-
ENT 312	Venture Creation	2	C	15	45
GET 301	Engineering Mathematics III	3	C	30	-
GET 302	Engineering Mathematics IV	3	C	45	-
GET 304	Technical Writing and Communication (including Seminar Presentation Skills)	3	C	45	-
GET 305	Engineering Statistics and Data Analytics	3	C	45	-
GET 306	Renewable Energy Systems and Technology	3	C	30	45
GET 307	Introduction to AI, ML and Convergent Technologies	3	C	45	-
MCE 321	Design of Mechatronics and Robotics Systems I	2	C	30	-
GET 399	SIWES II	4	C	-	12wks
GET308	Engineering Economics	3	C	45	-

Course Code	Course Title	Units	Status	LH	PH
MCE301	Control Engineering Fundamentals	3	C	45	45
MCE302	Digital Electronics	2	C	30	-
MCE303	Electrical Circuits Analysis	2	C	30	45

MECHATRONICS - LEVEL 400 COURSES

Course Code	Course Title	Units	Status	LH	PH
MCE 401	Computer Vision and Image Processing	2	E	30	-
MCE 403	Micro-controller and Embedded Systems	2	E	30	-
MCE 405	Control Engineering	2	E	15	45
MCE 407	Industrial Automation and Control	2	E	30	-
MCE 409	Sensors and Actuators	2	E	30	-
GET 499	SIWES III	8	C	-	24wks
MCE401	Design of Machine Elements	2	C	30	-
MCE403	Discrete Control Systems	2	C	30	45
MCE405	Electromechanical Devices	3	C	45	-
MCE407	Measurements and Instrumentation	2	C	30	45
MCE409	Group Project	2	C		30

MECHATRONICS - LEVEL 500 COURSES

Course Code	Course Title	Units	Status	LH	PH
GET 501	Engineering Project Management	3	C	45	-
GET 502	Engineering Law	2	C	30	-
MCE 501	Design of Mechatronics & Robotics Systems II	2	E	-	90
MCE 590	BEng Final Year Project	6	C	-	270
MCE 501	Mechanical Vibration	2	C	30	-
MCE 502	Reliability and Fault Detection	2	C	30	-
MCE 503	Linear Multivariable Control	2	C	30	-
MCE 504	Mobile Robotics	2	E	30	-
MCE 505	Autonomous Vehicle Guidance Systems	2	E	30	-
MCE 506	Computer Software Engineering	2	E	30	-
MCE 507	Introduction to VLSI Design Concept	2	E	30	45
MCE 508	Micro-Electro-Mechanical Systems (MEMS) for Mechatronics	2	E	30	45

Course Code	Course Title	Units	Status	LH	PH
MCE 509	Digital Signal Processing	2	E	30	45
MCE 510	Electric Drives	2	E	30	-
	Elective	2	E	30	-
	Elective	2	E	30	-