SCHOOL OF SCIENCE AND TECHNOLOGY
PAN-ATLANTIC UNIVERSITY

Programme Manual

B.Eng. Electrical and Electronic Engineering

1.0. Mission

The mission of the School of Science and Technology is as follows:

The School of Science and Technology (SST) is a community of people committed to creating and transmitting knowledge and competencies in science, engineering and technology by "*forming competent and socially responsible science and engineering professionals who are committed to the promotion of the common good of society and the advancement of the scientific and engineering profession".* In order to achieve this mission, the School seeks to:

- *Provide practice-based, student-centred and industry-relevant programs that address technical expertise, industrial management and ethical responsibility.*
- *Develop partnerships and engage with relevant stakeholders through applied research that provides solutions to industry and societal problems and enhance engineering pedagogy.*
- *Provide entrepreneurship education along with science and engineering education.*
- *Make intellectual contributions which:*
    a) *Support the practice of science, engineering and technology;*
    b) *Contribute to the advancement of the science, engineering and technology disciplines; and*
    c) *Create high quality teaching materials.*
- *Produce graduates who will lead efforts to achieve ever greater scientific, engineering and technology development with high ethical standards.*

2.0 Hands-on training: Student-centred with strong ties to industry

To ensure industry relevance of engineering programmes our pedagogy will be in line with the world-class global best practices having engineering education delivery process that are student-centred with strong ties to industry driven by our programme educational objectives.

2.1. Programme Educational Objectives:

The SST programme educational objectives will be periodically reviewed with the full involvement of all key stakeholders including faculty members, students, advisory board members, alumni, and employers of graduates. Presently, the career and professional accomplishments that our programmes are preparing graduates to attain within a 3-5 years of graduation are:

Start-ups & innovative Entrepreneurs	**Graduates will become principals in the industries associated with engineering and professional engineers starting-up and growing their own new firms. They will become recognized experts working in government, consulting firms, and international organisations**

	around the country and around the world addressing some of the most challenging problems of our times. With reputation as a source of innovative solutions to complex problems, technology leaders in start-up tech companies based on societal demands, national needs, and competitive international markets.
Researchers	Graduates will become leading researchers who create and disseminate new knowledge in engineering. They will complete masters and PhD programs of respected universities by conducting original research in related disciplines or in interdisciplinary topics, contribute to scientific community with novel research activities, and continue their field in permanent academic positions work in engineering, research and development, production, operations and management departments of Nigerian, African or international companies as engineers who can solve technical problems, take initiative, develop and execute projects, collaborate with others in a team and take the responsibilities of a leader.
Lifelong Learning	Graduates will pursue lifelong learning in generating innovative engineering solutions using research and complex problem-solving skills.
Ethical Professional Engineer	Graduates will demonstrate technical competency and leadership to be working as engineering professionals (registered engineers), acting ethically, adhering to standards, and be committed to the welfare of employees and the general population.

2.2. Student Outcomes:

At graduation, our students are expected to know and able to do the following:

Engineering knowledge	**Apply knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of developmental and complex engineering problems.**
Problem Analysis	Identify, formulate, research literature, and analyse developmental and complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
Design and development of solutions	Proffer solutions for developmental or complex engineering problems and design systems, components or processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal, and environmental considerations.
Investigation	Conduct investigation into developmental or complex problems using research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of information to provide valid conclusions.
Modern Tool Usage	Create, select, and apply appropriate techniques, resources and modern engineering and ICT tools, including prediction, modelling and optimization to developmental and complex engineering activities, with an understanding of the limitations.

The Engineer and Society	Apply reasoning informed by contextual knowledge including Humanities and Social Sciences to assess societal, health, safety, legal and cultural issues, and the consequent responsibilities relevant to professional engineering practice.
Environment & Sustainability	Understand the impact of professional engineering solutions in societal and environmental contexts and demonstrate knowledge of and need for sustainable development.
Ethics	Apply ethical principles and commit to professional ethics and responsibilities and norms of engineering practice, including adherence to the COREN Engineers Code of Conducts.
Individual and Teamwork	Function effectively as an individual, and as a member or leader in diverse teams and in multi-disciplinary settings.
Communication	Communicate effectively on developmental or complex engineering activities with the engineering community and with society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
Project Management and Finance	Demonstrate knowledge and understanding of engineering, management and financial principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multi-disciplinary environments.
Lifelong learning	Recognize the need for and have the preparations and ability to engage in independent and lifelong learning in the broadest context of technological and social changes.

2.2 Mapping of Student Outcomes to Programme Educational Objectives

Student Outcomes	**Programme Educational Objectives**			
	Start-ups & innovative Entrepreneurs	Researchers	Lifelong Learning	Ethical Professional Engineer
Engineering knowledge	■	■		
Problem Analysis	■	■		
Design /development of solutions	■			
Investigation		■		
Modern Tool Usage	■	■	■	
The Engineer and Society				■
Environment & Sustainability	■			
Ethics	■			■
Individual and Teamwork	■		■	
Communication	■	■		
Project Management and Finance	■			■
Lifelong learning			■	

3. Basic Principles

The following are the basic principles which will inform the teaching imparted in the B.Eng. programmes of the School of Science and Technology:

- Human beings are moral beings whose behaviour are not mechanically determined by either internal or external factors and who cannot attain fulfilment if they restrict their activity to the pursuit of their own individual interests.
- The purpose of an enterprise is not restricted to producing profits for their owners nor can the objective of maximising profit be the supreme standard of decision. Organisations are members of larger societies and must contribute to their common good. The activities of organisations must also be compatible with - and contribute to - the full human development of those who work in them.
- Organisations are not mere production units. First and foremost they must be human communities where all have an opportunity to participate and contribute responsibly to the common good of the organisation and that of society.
- Organisations are not justified in creating and marketing products or services by the mere fact that a demand for them exists or can be created. The value of the organisation's activity ultimately depends on its serving authentic human needs and values.
- Organisations must respect the dignity of all the human persons (employees, customers, suppliers...) with whom they relate in the exercise of their activity. A person's dignity is not respected when one chooses to harm him or her, even if this is done as a means to attain some desirable objective.

4.0 Philosophy

The general philosophy of the Electrical and Electronic Engineering (EEE) programme is to produce graduates with high academic and soft skills competence, capable to adequately participate, transform and impact on the Engineering and allied industries in consonance with National and Global community values, including National Policy on Industrialization and Self-Reliance. The programme therefore aims at:

1. Exploring the importance of efficient and sustainable solutions for Electrical and Electronic Engineering challenges, such as achieving sustainable electricity generation, secure distribution, and intelligent communication systems;
2. Providing ample opportunity for practical application and project work as emphasized throughout the course; and
3. Producing EEE graduates of high academic and ethical standards with adequate practical exposure for self-employment as well as being of immediate value to industry and the community in general.

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

The Degree programme in Electrical and Electronic Engineering of the Pan-Atlantic University is intended to provide a solid foundation in the principles and practices of engineering for young people who look forward to a career in engineering. It is also a preparation for those young people interested in an academic career and entrepreneurship in the area of engineering.

Emphasis will be given to the knowledge of problem solving approaches, critical thinking about, and in-depth analysis of, engineering issues and problems, and the acquisition of a capacity for ethical and competent professional performance.

Furthermore the programme is informed by the aspiration to train electrical/electronic engineering professionals in the areas of design, building and maintenance of electrical control systems, electric power, electronic devices, power electronics, microcomputers, digital electronics, electrical machines, instrumentation, communication networks, etc., and who would uphold the highest intellectual, ethical and professional values that promote creativity, social responsibility, and the spirit of enterprise.

The programme will prepare students for careers in the vast areas where electrical and electronic engineering is applied such as in telecommunications, power generation and distribution, renewable energy, manufacturing, aviation/aerospace, automotive, information technology, lighting, heating, ventilation and air-conditioning (HVAC) systems, military hardware, utilities, consultancy, general maintenance and construction industries, etc. With the skills students will acquire in this programme, they will be better equipped to contribute to improving national productivity and economic growth in general while earning a decent living.

Electrical and Electronic Engineering is a dynamic, fascinating and rapidly growing area that has become an integral part of the world that we live in today. It occupies a central position in our daily life, both in homes and in the workplace. The need for individuals with good electrical and electronic engineering skills and competencies will continue to grow.

5.0. Objectives

The fundamental aim of the Electrical and Electronic Engineering programme is tied to that of the University through the School of Science and Technology. It is *to form competent and socially responsible engineering professionals who are committed to the promotion of the common good of society and the advancement of the engineering profession*. The programme further aims to produce engineering manpower with the adequate knowledge and skills to handle engineering situations/problems competently and ethically. To achieve this, the programme will prepare the graduates to:

1. apply knowledge of Science, Technology, Engineering and Mathematics (STEM) fundamentals to the solution of Electrical and Electronics Engineering related problems;
2. design solutions for Electrical and Electronics Engineering problems and design systems, components or processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal, environmental and other ethical considerations;
3. conduct investigations of complex problems using research-based knowledge and research methods, including design of experiments, analysis and interpretation of data andsynthesis of information to provide valid conclusions;
4. create, select and apply appropriate techniques, resources and modern Engineering and IT tools: including prediction and modeling, to complex Engineering activities, with an understanding of the limitations;
5. function effectively both as an individual and as a team member or leader in diverse and in multi-disciplinary settings;
6. communicate effectively on complex Engineering activities with the Engineering community and with society at large, such as being able to comprehend and write effectivereports and design documentation, make effective presentations, as well as, give and receive clear instructions;
7. demonstrate knowledge and understanding of Engineering and Management principles and equally apply them in managing multi-disciplinary projects;
8. nurture partnership between the institution and industry for effective programme delivery;
9. create awareness and understanding of the moral, ethical, legal, and professional obligations needed to function as part of a professional enterprise while protecting humanhealth and welfare and the environment in a global society; and
10. develop entrepreneurial skills and knowledge, in addition to adequate training in human and organizational systems with the spirit of self-reliance so that they can set up their ownbusinesses.

Other specific objectives of the programme are:

- Provide a high quality Bachelors programme in the area of Electrical and Electronic Engineering comparable to the best in the world.
- To prepare high calibre of electrical and electronic engineering graduates who are well equipped with requisite knowledge, skills, competencies and practices of electrical/electronic engineering in order to serve the needs of local and international industries in the private and public sectors.
- To involve the students in an intellectually stimulating and satisfying experience of engaged learning through continuous professional development activities that adapts to changes in the work environment.
- To prepare the students to play key roles in the professional engineering bodies.
- To provide students with knowledge and skills base for further studies in electrical and electronic engineering or multi-disciplinary studies in science and technology.

6.0 Admission and Matriculation Requirements

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

1. Indirect Entry (5 Year Degree Programme)
2. Direct Entry (4 Year Degree Programme)

Prospective students would need to satisfy the following general requirements:

Indirect Entry

(a) Admissions shall be through the Joint Admissions and Matriculations Board (JAMB);

(b) For Five year Indirect admission to 100-Level through the Unified Tertiary Matriculation Examination (UTME), candidates should:

i. Obtain at least five (5) credit passes at Senior Secondary School Certificate Examination (SSSCE) or equivalent in relevant subjects including English Language, Mathematics, Physics, Chemistry and other acceptable science subject at not more than two sittings;
ii. Score preferably a minimum of 220 points in UTME. The minimum point required is subject to review by the University from time to time.
iii. Pass the Post-UTME interview organized by the university.
iv. It is also desirable for candidates to pass Further Mathematics and Technical Drawing at credit level, such candidates shall have added advantage.

Direct Entry

(c) For Four year Direct Entry admission into 200-Level (Direct Entry), candidates should (in addition to 5 SSCE credits in relevant subjects including English Language and Mathematics in not more than two sittings):
Credit passes in Mathematics, Physics and Chemistry at GCE 'A' level or equivalent. Holders of National Diploma at minimum of Upper Credit level are eligible for consideration for admission into 200 level. They are also required to pass the interview organized by the university.

(d) *Inter-University Transfer Mode*
Students can transfer into 200-Level courses provided they have the relevant qualifications and pass the interview organized by the Pan-Atlantic University (PAU). PAU is to satisfy itself that the grades obtained by such candidates from their previous institution are acceptable.

7.0 The Semester Course System

The undergraduate programmes will run on the Semester Course basis. There shall ordinarily be two semesters in an academic year, except the University Council through Senate shall provide otherwise.

(i) Instruction in the programme shall be by courses.
(ii) There shall be five levels of courses in line with the years of study. Level or year 1 courses are 100, 101 etc. and Level 2 or year 2 courses are 200, 201 etc.
(iii) Students will be required to complete their registration for the courses within the period stipulated by the School. Amendment of this registration will be allowed through the addition or deletion of courses but it must take place within three weeks of the commencement of lectures.

8.0 Examination and Grading System

Students will be evaluated through a combination of Laboratory Experiments, Continuous Assessment Tests (30%), End-of-Semester Examinations (65%), Class participation (5%) and Class/Laboratory Attendance.

To be eligible to sit for any examinations, students will be expected to attend a minimum of 80% of the lectures of any course registered for. The School reserves the right to prevent any defaulting student from sitting for the relevant examination.

All courses registered for will be taken into consideration during the computation of results. Students will not be credited for courses which they did not register for, even if they are inadvertently allowed to take the examinations and pass them. Failure to take the examination in a course for which one has registered will attract a score of 0.0, which will have the consequent effect of lowering the student's Grade Point Average.

(i) Special examinations to enable a student graduate may in exceptional circumstances be held by order of Senate.
(ii) Grades will be awarded based on the scores of the students as follows:

Percent score	Grade point	Letter Grade
70 – 100	5.0	A
60 – 69.9	4.0	B
50 – 59.9	3.0	C
45 – 49.9	2.0	D
40 – 44.9	1.0	E
0 – 44.9	0.0	F

For the purpose of description, a score below 2 Grade Points constitutes a failure. The following qualifications shall be applied to the grades:

A	Very Good
B	Good
C	Fair
D	Pass
E	
F	Poor Performance

(iii) To obtain the Cumulative Grade Point Average (CGPA) of the student, the grade point assigned to the mark obtained in each course is multiplied by the units of that course. The total from all the courses is added up to give the total weighted grade point. This total is then divided by the total number of units taken by the student to give the grade point average.

(iv) For the purpose of calculating a student's CGPA, grades obtained in ALL registered courses, whether compulsory or optional and whether passed or failed, must be included in the computation.

9.0 Retention and Progression

To remain in the School, students will be required to ensure that their CGPA does not fall below a certain minimum standard. A student must pass all the specified courses, and obtain a minimum CGPA of 1.5 at the end of every semester. Any student who does not meet this requirement will be placed on probation. If after one semester on probation the CGPA remains below 1.5, the student shall be asked to withdraw. A student on probation should register for a maximum of 18 credit units.

10.0 Period of Study and Requirements for the Award of a Degree

The following regulations shall govern the conditions for the award of a honours degree.

a) Candidates admitted through the UTME indirect entry (5-year, 10-semester programme) mode shall have registered for at least **161 units** of courses during the 5-year degree programme. Candidates must have registered and passed all the compulsory courses specified for the programme.
b) Candidates admitted through direct entry (4-year, 8-semester programme) mode shall have registered for at least **125 units** of courses during the 4-year degree programme.

The determination of the class of degree shall be based on the weighted grade points of all the courses taken. The award of the degree shall be dependent on the student having

obtained a Cumulative Grade Point Average of at least 1.5 in addition to fulfilling other minimum requirements for an honours degree.
The following classes of degree are approved for the CGPA indicated:

Class of Degree	Cumulative GPA
First Class	**4.50 - 5.00**
Second Class (*Upper Division*)	**3.50 – 4.49**
Second Class (*Lower Division*	**2.40 – 3.49**
Third Class	**1.50 – 2.39**
Fail	**Less than 1.5**

The maximum number of semesters for the award of an honours degree shall be fourteen semesters.

11.0 Graduation Requirements

To qualify for the award of a degree of Pan-Atlantic University, a student is required to have:

(i) Completed and passed the prescribed number of units including all compulsory courses specified by the University.
(ii) Completed and met the standards for all required and elective courses.
(iii) Obtained the prescribed minimum CGPA.

12.0 CURRICULUM FOR B.Eng. DEGREE IN ELECTRICAL AND ELECTRONIC ENGINEERING IN AGREEMENT WITH THE NUC CCMAS (2023) & COREN OBE

NOTE the following legend for the list of courses below

C = COMPULSORY
E = Elective
R = Required
LH = Lecture Hours per semester
PH = Practical Hours per semester

Course Structure at 100-Level Engineering Degree Programme

Course Code	Course Description Semester I	Units	Status	PREQ	LH	PH
GET 100	Remedial Technical Drawing	0	E			45
EEE 102	Introduction to Electrical and Electronic Engineering	2	C	-	30	
GET 101	Engineer in Society	1	C		15	
CHM 101	General Chemistry I	2	C	-	30	
CHM 107	General Practical Chemistry I	1	C	-		45
MTH 101	Elementary Mathematics I (Algebra & Trigonometry)	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
PAU-EEE 191	Introduction to Christian Theology	2	C		30	
GST 111	Communication in English	2	C	-	15	45
	TOTAL UNITS	**17**				
Course Code	**Course Description Semester II**	**Units**	**Status**	**PREQ**	**LH**	**PH**
PAU-EEE 103	General Physics III (Electricity, Magnetism)	2	C		30	
PAU-EEE 104	General Physics IV (Vibration, Waves and Optics)	2	C		30	
MTH 102	Elementary Mathematics II (Calculus)	2	C		30	
MTH 103	Elementary Mathematics III (Vectors, Geometry and Dynamics)	2	C		30	
GET 102	Engineering Graphics & Solid Modelling	2	C	-	30	
CHM 102	General Chemistry II	2	C	-	45	
CHM 108	General Practical Chemistry II	1	C	-		45
PHY 108	General Practical Physics II	1	C	-		45
GST 112	Nigerian People's and Culture	2	C	-	30	
PAU-EEE 112	Probability for Engineers	3	C		45	
	TOTAL UNITS	**19**				

Course Structure at 200-Level Engineering Degree Programme

Course Code	Course Description Semester I	Units	Status	PREQ	LH	PH
GET 201	Applied Electricity I	3	C	-	45	
GET 203	Engineering Graphics and Solid Modeling II	2	C	-	15	45
GET 205	Fundamentals of Fluid Mechanics	3	C	-	45	
GET 207	Applied Mechanics	3	C	-	45	
GET 209	Engineering Mathematics I	3	C	-	45	
GET 211	Computing & Software Engineering	3	C	-	30	45
EEE 204	Electrical Engineering Materials	3	C	-	45	
ENT 211	Entrepreneurship and Innovation	2	C	-	30	

PAU-EEE 292	The Nature of Human Beings	2	C		30	
	TOTAL UNITS	**24**				
Course Code	**Course Description Semester II**	**Units**	**Status**	**PREQ**	**LH**	**PH**
EEE 202	Applied Electricity II	3	C	-	30	45
GET 204	Student Workshop Practice	2	C		15	45
GET 206	Fundamentals of Thermodynamics	3	C	-	45	-
PAU-EEE 208	Strength of Materials	3	C		45	
GET 210	Engineering Mathematics II	3	C	-	45	
GST 212	Philosophy, Logic and Human Existence	2	C	-	30	
	TOTAL UNITS	**16**				
***GET 299**	SIWES I: Student Work Experience Scheme	**3**	C	-	9 weeks	

Course structure at 300-Level Electrical/Electronic Engineering

Course Code	**Course Description Semester I**	**Units**	**Status**	**Preq**	**LH**	**PH**
EEE 321	Analogue Electronic Circuits	2	C	-	30	
EEE 311	Electric Circuit Theory I	2	C	-	30	
PAU-EEE 311	Electromechanical Systems	2	R		30	
PAU-EEE 313	Laboratory Practicals I	2	R	-		90
GET 301	Engineering Mathematics III	3	C	-	45	
GET 305	Engineering Statistics & Data Analytics	3	C		45	
GET 306	Renewable Energy Systems & Technologies	3	C	-	30	45
GST 312	Peace & Conflict Resolution	2	C	-	30	
ENT 312	Venture Creation	2	C	-	15	45
	TOTAL UNITS	**21**				
				-		
Course Code	**Course Description Semester II**	**Units**	**Status**	**Preq**	**LH**	**PH**
EEE 322	Digital Electronic Circuits	2	C	-	30	
EEE 324	Electromagnetic Fields and Waves I	2	C	-	30	-
EEE 326	Electric Circuit Theory II	2	E		30	
PAU-EEE 308	Data Communications and Networks	2	R	-	30	
PAU-EEE 310	Electric Machines	2	R		30	
PAU-EEE 312	Laboratory Practicals II	2	C	-		90
GET 302	Engineering Mathematics IV	3	C	-	45	
GET 304	Technical Writing & Communication	3	C	-	45	
GET 307	Introduction to Artificial Intelligence, Machine Learning & Convergent Technologies	3	C	-	45	
	TOTAL UNITS	**21**				
GET 399	SIWES II: Student Experience Work Scheme	4	C	-	12 weeks	

Course structure at 400-Level Electrical/Electronic Engineering

Course Code	Course Description Semester I	Units	Status	Preq	LH	PH
PAU-EEE 401	Professional Ethics for Engineers	2	C		30	
PAU-EEE 403	Principles of Communication Engineering	2	R	-	30	
PAU-EEE 405	Electric Power Systems	2	R	-	30	-
PAU-EEE 407	Introduction to Control Systems Engineering	3	R	-	45	-
PAU-EEE 409	Power Electronics & Drives	2	R	-	30	
PAU-EEE 411	Laboratory Practicals III	2	R			90
	TOTAL UNITS	**13**				
Course Code	**Course Description Semester II**	**Units**	**Status**	**Preq**	**LH**	**PH**
PAU-EEE 402	Industrial Automation & Controls (Electro-pneumatics & Programmable Logic Controls - PLC)	2	R		15	45
PAU-EEE 413	Engineering Economics	2	C		30	
GET 402	Engineering Project I	2	C			90
GET 404	Engineering Valuation and Costing	2	C		30	
	TOTAL UNITS	**8**				
GET 499	SIWES III (4th year)	4	C	-	12 weeks	

Course structure at 500-Level Electrical/Electronic Engineering

Course Code	Course Description Semester I	Units	Status	Preq	LH	PH
EEE 593	Final Year Project I	3	C			135
GET 501	Engineering Project Management	3	C		45	
	TOTAL UNITS	**6**				
PAU-EEE 510	Engineering Management	2	C		30	
EEE 594	Final Year Project II	3	C			135
GET 502	Engineering Law	2	C		30	
	TOTAL UNITS	**7**				
	GROUPS OF ELECTIVES (Up to 5 credits)					
	COMPUTER & CONTROL ENGINEERING OPTION					
PAU-EEE 506	Digital Signal Processing	2	E	-	30	
	POWER AND MACHINES OPTION					
PAU-EEE 512	Switchgear and High Voltage Engineering	2	E	-	30	-
	COMMUNICATION & ELECTRONICS OPTION					
PAU-EEE 514	Digital Communications Systems	2	E		30	

Course Contents and Learning Outcomes

100-Level

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

Learning Outcomes

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

1. identify possible sound patterns in English Language;
2. list notable language skills;
3. classify word formation processes;
4. construct simple and fairly complex sentences in English;
5. apply logical and critical reasoning skills for meaningful presentations;
6. demonstrate an appreciable level of the art of public speaking and listening; and
7. write simple and technical reports.

Course 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 argument, 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, curriculumvitae, report writing, note-making) etc. Mechanics of writing. Information and CommunicationTechnology in modern language learning. Language skills for effective communication. The art of public speaking.

GST 112: Nigerian Peoples and Cultures (2 Units C: LH 30)

Learning Outcomes

At the completion of the course, the students are expected to be able:

1. analyse the historical foundation of Nigerian cultures and arts in pre-colonial times;
2. identify and listthe major linguistic groups in Nigeria;
3. explain the gradual evolution of Nigeria as a political entity;
4. analyse the concepts of trade andeconomic self-reliance of Nigerian peoples in relation tonational development;
5. enumerate the challenges of the Nigerian state regarding nation building;
6. analyse the role of the udiciary in upholding fundamental human rights
7. identify the acceptable norms and values of the major ethnic groups in Nigeria; and
8. list possible solutions to identifiable Nigerian environmental, moral and value problems.

Course Contents
Nigerian history, culture and art up to 1800 (Yoruba, Hausa and Igbo peoples and cultures; peoples and cultures of the minority ethnic groups). Nigeria under colonial rule (advent of colonial rule in Nigeria; colonial administration of Nigeria). Evolution of Nigeria as a political unit (amalgamation of Nigeria in 1914; formation of political parties in Nigeria; nationalist movement and struggle for independence). Nigeria and challenges of nation building (military intervention in Nigerian politics; Nigerian Civil War). Concepts of trade and economics of self- reliance (indigenous trade and market system; indigenous apprenticeship system among Nigerian peoples; trade, skill acquisition and self-reliance). Social justice and national development (definition and classification of law); Judiciary and fundamental rights. Individuals, norms and values (basic Nigerian norms and values, patterns of citizenship acquisition; citizenship and civic responsibilities; indigenous languages, usage and development; negative attitudes and conducts [Cultism, kidnapping and other related social vices]). Re-orientation, moral and national values (The 3Rs – Reconstruction, Rehabilitation and Re-orientation; re-orientation strategies: Operation Feed the Nation (OFN), Green Revolution, Austerity Measures, War Against Indiscipline and Corruption (WAIC), Mass Mobilization for Self-Reliance, Social Justice and Economic Recovery (MAMSER), National Orientation Agency (NOA). Current socio-political and cultural developments in Nigeria.

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

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

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

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, infrastructures and nation building - economy, politics, business. Safety and risk analysis in engineering practice. Engineering competency skills – curriculum overview, technical, soft and digital skills. Guest seminars and invited lectures from different engineering professional associations.

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

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

1. have a good grasp of design thinking and be obsessed with the determination to apply such to solving simple everyday and also complex problems;

2. recognise the fundamental concepts of engineering drawing and graphics;
3. show skills to represent the world of engineering objects in actionable solid models, and put such models in a form where they can be inputs for simulation and analyses;
4. andanalyse such models for strength and cost.
5. prepare the objects for modern production and manufacturing techniques of additive and subtractive manufacturing;
6. recognise that engineering is multidisciplinary in the sense that mechanical, electrical and other parts of physical structures are modelled in context as opposed to the analytical nature of the courses they take;and
7. analyse and master the basics of mechanical and thermal loads in engineering systems.

Course 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 edgeor equivalent.

CHM 101: General Chemistry I (2 Units C: LH 45)

Learning Outcomes

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

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

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

Learning Outcomes

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

1. state the general laboratory rules and safety procedures;
2. collect scientific data and correct carry out chemical experiments;
3. identify the basic glassware and equipment in the laboratory;
4. state the differences between primary and secondary standards;
5. perform redox titration;
6. record observations and measurements in the laboratory notebooks; and
7. analyse the data to arrive at scientific conclusions.

Course Contents

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

CHM 102: General Chemistry II (2 Units C: LH 30)

Learning Outcomes

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

1. state the importance and development of organic chemistry;
2. define fullerenes and its applications;
3. discuss electronic theory;
4. determine the qualitative and quantitative of structures in organic chemistry;
5. state rules guiding nomenclature and functional group classes of organic chemistry;
6. determine the rate of reaction to predict mechanisms of reaction;
7. identify classes of organic functional group with brief description of their chemistry;
8. discuss comparative chemistry of group 1A, IIA and IVA elements; and
9. describe basic properties of transition metals.

Course 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.

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

Learning Outcomes

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

1. define and explain set, subset, union, intersection, complements, and demonstrate theuse of Venn diagrams;
2. solve quadratic equations;
3. solve trigonometric functions;
4. identify various types of numbers; and
5. solve some problems using binomial theorem.

Course 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, nth 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)

Learning Outcomes

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

1. identify the types of rules in differentiation and integration;
2. recognise and understand the meaning of function of a real variable, graphs, limits and continuity;
3. solve some applications of definite integrals in areas and volumes;
4. solve function of a real variable, plot relevant graphs, identify limits and idea of continuity;
5. identify the derivative as limit of rate of change;
6. identify techniques of differentiation and perform extreme curve sketching;
7. identify integration as an inverse of differentiation;
8. identify methods of integration and definite integrals; and
9. perform integration application to areas, volumes.

Course 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).

MTH 103: Elementary Mathematics III (Vectors, Geometry and Dynamics) (2 Units C: LH 30)

Learning Outcomes

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

1. solve some vectors in addition and multiplication;
2. calculate force and momentum; and
3. solve differentiation and integration of vectors.

Course Contents

(Pre-requisite –MTH 101)

Geometric representation of vectors in 1-3 dimensions, components, direction cosines. Addition, scalar, multiplication of vectors, linear independence. Scalar and vector products of two vectors. Differentiation and integration of vectors with respect to a scalar variable. Two-dimensional co-ordinate geometry. Straight lines, circles, parabola, ellipse, hyperbola.

Tangents, normals. Kinematics of a particle. Components of velocity and acceleration of a particle moving in a plane. Force, momentum, laws of motion under gravity, projectiles and resisted vertical motion. Elastic string and simple pendulum. Impulse, impact of two smooth spheres and a sphere on a smooth surface

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

Learning Outcomes

On completion, the students should be able to:

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

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; applicationof 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)

Learning Outcomes
On completion, the students should be able to:

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

Course 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 andbubbles.

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

Learning Outcomes
On completion, the student should be able to:

1. conduct measurements of some physical quantities;
2. make observations of events, collect and tabulate data;
3. identify and evaluate some common experimental errors;
4. plot and analyse graphs; and
5. draw conclusions from numerical and graphical analysis of data.

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)

Learning Outcomes
On completion, the student should be able to:

1. conduct measurements of some physical quantities;
2. make observations of events, collect and tabulate data;
3. identify and evaluate some common experimental errors;
4. plot and analyse graphs;
5. draw conclusions from numerical and graphical analysis of data; and
6. prepare and present practical reports.

Course 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 thathave 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.

EEE 102: Introduction to Electrical and Electronics Engineering. (2 units C: LH 30)

Learning Outcomes
Students will be able to:

1. comprehend the duties and functions of an Electrical and Electronics Engineer (EEE);
2. requirements for the profession and career opportunities; and
3. state the careers related to EEE; explain the future of EEE.

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

PAU-EEE 103 – General Physics III (Electricity, Magnetism) (2 Units C; L= 30)

Learning Outcomes

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

1. describe the electric field and potential, and all related concepts, for stationary charges;
2. explain at least two electrostatic properties of simple charge distributions using Coulomb's law, Gauss's law, and electric potential;

3. illustrate the magnetic field for steady and moving charges;
4. describe at least three magnetic properties of simple current distributions using Biot-Savart and Ampere's law;
5. describe electromagnetic induction and related concepts and make calculations using Faraday and Lenz's laws for each;
6. explain the at least five basic physical significance of Maxwell's equations in integral form;
7. demonstrate the DC circuits to determine the electrical parameters; and
8. identify at least two characteristics of AC voltages and currents in each of resistors, capacitors, and Inductors.

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.

PAU-EEE 104 General Physics IV (Vibration, Waves and Optics) (2 Units C; L= 30)

Learning Outcomes

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

1. describe and quantitatively analyse the behaviour of vibrating systems and wave energy;
2. explain the propagation and at least six properties of waves in sound and light;
3. identify and apply the wave equations;
4. explain geometrical optics and principles of optical instruments; and
5. demonstrate simple harmonic motion.

Course Contents

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

PAU-EEE 112 Probability for Engineers (3 Units C; L= 30).

Learning outcomes

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

1. outline at least four probability of events in a sample space;
2. illustrate the mathematical representations of some special theoretical probability distribution functions as well as how to use them in computing the probability of random events;
3. demonstrate the moments and mathematical expectations of random variables;
4. describe the nature of Bayesian probability and at least five applications; and
5. compare the probability distribution functions taught in class.

Course content

Introduction to probability and its axioms. Mutually exclusive and independent events. Addition and multiplication rules of probability. Conditional probability. Independence of Bayes' theorem. Random variables. Mathematical expectations. Moments of random variables. Laws of large numbers. Chebyshev's inequality. Special probability distributions. Bernoulli distribution. Binomial distribution. Geometric distribution. Negative binomial distribution. Poisson, hypergeometric distribution. Normal distribution. Weibull distribution.

PAU-EEE 191 Introduction to Christian Theology (2 Units C; L= 30).

Learning Outcomes
On completion of the course, the students should be able to:

1. discuss at least three philosophical arguments about the existence of God
2. explain the relationship between science and faith using at least three concrete examples.
3. explain three modern theories about the relationship between creation and evolution.
4. analyze human actions to determine their morality based on the three criteria of action, circumstance, and intention.
5. list and explain the Ten Commandments and their implications.
6. explain at least five consequences of mishandling the truth, detraction and defamation.
7. explain five contemporary issues relating to human life and drug use.

Course contents
The Existence of God. Divine Revelation. Creation and Evolution. Jesus Christ: both man and God. Eschatology. Human Freedom and Natural Law. Moral Conscience. Factors that determine the Morality of Human Acts. Personal Sin and Responsibility. Influence of the Passions in Human Actions. The Virtues. Introduction to the Ten Commandments. Contemporary human Life issues. Contemporary sexual issues. The morality of Gambling. Contemporary issues regarding handling the truth. Christian Prayer.

200 Level

GST 212: Philosophy, Logic and Human Existence (2 Units C: LH 30)Learning Outcomes

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

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

Course Content

Scope of philosophy; notions, meanings, branches and problems of philosophy. Logic as an indispensable tool of philosophy. Elements of syllogism, symbolic logic— the first nine rules ofinference. 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.

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

Learning Outcomes

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

1. explain the concepts and theories of entrepreneurship, intrapreneurship, opportunity seeking, new value creation and risk-taking;
2. state the characteristics of an entrepreneur;
3. analyse the importance of micro and small businesses in wealth creation, employment generation and financial independence;
4. engage in entrepreneurial thinking;
5. identify key elements in innovation;
6. describe the stages in enterprise formation, partnership and networking, includingbusiness planning;
7. describe contemporary entrepreneurial issues in Nigeria, Africa and the rest of the world;and
8. state the basic principles of e-commerce.

Course Content

The concept of entrepreneurship (entrepreneurship, intrapreneurship/corporate entrepreneurship); theories, rationale and relevance of entrepreneurship (Schumpeterian andother perspectives, risk-taking,

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

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

Learning Outcomes
Students will be able to:

1. discuss the fundamental concepts of electricity and electrical d.c. circuits;
2. state, explain and apply the basic d.c. circuit theorems;
3. explain the basic a.c. circuit theory and
4. apply to solution of simple circuits.

Course 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, and susceptance.

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

Learning Outcomes
Students should be able to:

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

Course 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.

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)

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

1. identify various basic hands and machine tools, analogue and digital measurement devices and instruments, and acquire skills in their effective use and maintenance;
2. practically apply basic engineering technologies, including metrology, casting, metal forming and joining, materials removal, machine tooling (classification, cutting tool action,cutting forces, non-cutting production) and CNC machining technology;
3. master workshop and industrial safety practices, accident prevention and ergonomics;
4. physically recognise different electrical & electronic components like resistances,inductances, capacitances, diodes, transistors and their ratings;
5. connect electric circuits, understand different wiring schemes, and check ratings of common household electrical appliances and their basic maintenance; and
6. determine household and industrial energy consumption, and understand practical energy conservation measures.

Course Contents
The course comprises general, mechanical and electrical components: supervised hands-on experience in safe usage of tools and machines for selected tasks; Use of measuring instruments (calipers, micrometers, gauges, sine bar, wood planners, saws, sanders, and pattern making). Machine shop: lathe work shaping, milling, grinding, reaming, metal spinning. Hand tools, gas and arc welding, cutting, brazing and soldering. Foundry practice.Industrial safety and accident prevention, ergonomics, metrology. Casting processes. Metal forming processes: hot-working and cold-working processes (forging, press-tool work, spinning, etc.). Metal joining processes(welding, brazing and soldering). Heat treatment. Material removal processes. machine tools and classification. Simple theory of metal cutting. Tool action and cutting forces. Introduction to CNC machines.

Supervised identification, use and care of various electrical and electronic components such as resistors, inductors, capacitors, diodes and transistors. Exposure to different electric circuits, wiring schemes, analogue and digital electrical and electronic measurements. Household and industrial energy consumption measurements. Practical energy conservation principles.

GET 205: Fundamentals of Fluid Mechanics (3 Units C: LH 45)

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

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

Course 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)

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

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

heat pumps; and

13. restate perpetual-motion machines, reversible and irreversible processes.

Course 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)

Learning Outcomes

Students will acquire the ability to:

1. explain the fundamental principles of applied mechanics, particularly equilibrium analysis, friction, kinematics and momentum;
2. identify, formulate, and solve complex engineering problems by applying principles of engineering, science, mathematics and applied mechanics;
3. synthesize Newtonian Physics with static analysis to determine the complete load impact (net forces, shears, torques, and bending moments) on all components (members and joints) of a given structure with a load; and
4. apply engineering design principles to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.

Course Contents

Forces, moments, couples. Equilibrium of simple structures and machine parts. Friction. Firstand 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 209: Engineering Mathematics I (3 Units C: LH 45)

Learning Outcomes

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

1. solve qualitative problems based on vector and matrix analyses such as linear independence and dependence of vectors, rank etc;
2. describe the concepts of limit theory and nth order differential equations and their applications to physical phenomena;

3. solve the problems of differentiation of functions of two variables and know about the maximization and minimization of functions of several variables;
4. describe the applications of double and triple integration in finding the area and volume of engineering solids, and explain the qualitative applications of Gauss, Stoke's and Green'stheorem;
5. explain ordinary differential equations and applications, and develop a mathematical model of linear differential equations, as well as appreciate the necessary and sufficient conditions for total differential equations; and
6. analyse basic engineering models through partial differential equations such as wave equation, heat conduction equation, etc., as well as fourier series, initial conditions and its applications to different engineering processes

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

Learning Outcomes

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

1. describe and apply computing, software engineering knowledge, best practices, and standards appropriate for complex engineering software systems;
2. develop competence in designing, evaluating, and adapting software processes and software development tools to meet the needs of an advanced development projectthrough practical object-oriented programming exposure taught in concrete terms with a specific modern language – preferable selected from Python, Java or C++;
3. use widely available libraries to prepare them for machine learning, graphics and design simulations;
4. develop skills in eliciting user needs and designing an effective software solution;
5. recognise human, security, social, and entrepreneurial issues and responsibilities relevant to engineering software and the digitalisation of services; and
6. acquire capabilities that can further be developed to make them productively employable by means of short Internet courses in specific areas.

Course 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 (3 Units C: 9 weeks)

Learning Outcomes
SIWES I should provide opportunity for the students to:

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

Course 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 are exposed to hands-on activities on workshop safety and ethics, maintenance of tools, equipment and machines, welding, fabrication and foundry equipment, production of simple devices; electrical circuits, wiring and installation, etc. (8-10 weeks during the longvacation following 200 level).

EEE 202: Applied Electricity II (3 Units C: LH 45

Learning outcomes

Students will be able to:

1. differentiate between various d.c. and a.c. machines;
2. explain the principles of operation of machines;
3. explain the operation of basic semiconductor devices and their basic applications; and
4. explain the principle of operation of communication systems with examples.

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

EEE 204 Electrical Engineering Materials (3 Units E: LH 45)

Learning Outcomes
Students will be able to:

1. discuss electron conduction mechanisms in semiconductors;
2. explain transport phenomena in semiconductors; and
3. describe semiconductors device fabrication techniques.

Couse contents
Free electron motion in static electric and magnetic fields, electronic structure of matter, conductivity in crystalline solids. Theory of energy bands in conductors, insulators and semiconductors: electrons in metals and electron emissions; carriers and transport phenomena in semiconductors, characteristics of some electron and resistors, diodes, transistors, photo cell and light emitting diode. Elementary discrete devices fabrication techniques and IC technology.

PAU-EEE 208 Strength of Materials (3 Units Core; L= 45)

Learning Outcomes

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

1. locate at least one structural system that is stable and in equilibrium;
2. identify the stress-strain relation for single and composite members based on Hooke's law;
3. estimate the stresses and strains in single and composite members due to temperature changes;
4. evaluate the distribution of shear forces and bending moments in beams with distributed and concentrated loads;
5. classify bending stresses and their use in identifying slopes and deflections in beams;
6. apply Mohr's circle to the evaluation of the normal and shear stresses in a multi-dimensional stress system and transformation of these stresses into strains;
7. evaluate the stresses and strains due to torsion on circular members; and
8. demonstrate the buckling loads of columns under various fixity conditions at the ends.

Course Contents

Consideration of equilibrium. Composite members. Stress-strain relation. Generalised Hooke's law. Stresses and strains due to loading and temperature changes. Torsion of circular members. Shear force. Distribution of shear forces. Bending moments and bending stresses in beams with symmetrical and combined loadings. Shear and moment diagrams for beams subjected to combination of concentrated loads. Slopes and deflections in beams. Stress and strain transformation equations. Mohr’s circle. Elastic buckling of columns. Buckling loads of columns under various fixity conditions.

PAU-EEE 292 The Nature of Human Beings (2 Units C; L= 30).

Learning Outcomes

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

1. explain at least seven basic concepts in Philosophical Anthropology.
2. list at least five aspects of the human person that reflect the difference between human beings and lower animals.

3. explain at least three different operations of the human intellect and will.
4. identify at least four institutions that develop the social nature of human beings.
5. list at least five consequences of good and bad uses of freedom.
6. explain at least four practical consequences of understanding human dignity in each of socio-political, economic, cultural, and technological development.
7. demonstrate knowledge of the four cardinal virtues and their relation to the development of the human person.
8. discuss at least three reasons why the idea of death shapes one's sense of meaning and human existence.

Course Content

Introduction and conceptual clarifications. Human beings as higher animals. Human emotions and emotional Intelligence. The rationality of human beings – intelligence and will. The unity of the human person. Human sexuality. The nature of Human Freedom. Freedom and truth. Freedom and Evil. Human beings as social beings. Expanded view of the social environment – virtual world and meta-verse. Human beings as working beings – the objective and subjective dimensions of human work. Human development – the virtues. The dignity of human beings and its practical consequences. Human fulfilment. Existence and the meaning of Life. The phenomenon of Human death.

300 Level

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

Learning Outcomes
At the end of this Course, students should be able to:

1. analyse the concepts of peace, conflict and security;
2. list major forms, types and root causes of conflict and violence;
3. differentiate between conflict and terrorism;
4. enumerate security and peace building strategies; and
5. describe the roles of international organisations, media and traditional institutions in peace building.

Course Contents
The concepts of peace, conflict and security in a multi-ethnic nation. Types and theories of conflicts: ethnic, religious, economic, geo-political Conflicts; structural conflict theory, realist theory of conflict, frustration-aggression conflict theory; root causes of conflict and violence in Africa: indigene and settlers phenomenon, boundaries/boarder disputes, political disputes, ethnic disputes and rivalries, economic inequalities, social disputes, nationalist movements and agitations; selected conflict case studies – Tiv-Junkun, ZangoKartaf, chieftaincy and land disputes, etc. Peace building, management of conflicts and security: Peace & Human Development. Approaches to Peace & Conflict Management (religious, government, community leaders.). 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 andits 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)

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

1. describe the key steps in venture creation;
2. spot opportunities in problems and in high potential sectors, regardless of geographical location;
3. state how original products, ideas and concepts are developed;
4. develop a business concept for further incubation or pitching for funding;
5. identify key sources of entrepreneurial finance;
6. implement the requirements for establishing and managing micro and small enterprises;
7. conduct entrepreneurial marketing and e-commerce;

8. apply a wide variety of emerging technological solutions to entrepreneurship; and
9. appreciate why ventures fail due to lack of planning and poor implementation.

Course 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. Digital business and e-commerce strategies.

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

Learning Outcomes

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

1. demonstrate a clear understanding of the course content, that is, possess a breadth of knowledge in the area covered;
2. possess an in-depth knowledge upon which a solid foundation can be built in order to demonstrate a depth of understanding in advanced mathematical topics;
3. develop simple algorithms and use computational proficiency;
4. write simple proofs for theorems and their applications;; and
5. communicate the acquired mathematical knowledge effectively in speech, writing and collaborative groups..
6.

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)

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

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

Course 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. Eigenvalue 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)

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

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

Course 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, 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 ofcorrespondences – 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 ofreports.

GET 305: Engineering Statistics and Data Analytics (3 Units C: LH 45)

Learning Outcomes

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

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

Course 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)

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

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

Course 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; 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 ConvergentTechnologies (3 Units C: LH 45)

Learning Outcomes

At the completion of the course, the students are expected to be able:

1. explain the meaning, purpose, scope, stages, applications and effects of artificialintelligence;
2. explain the fundamental concepts of machine learning, deep learning and convergent technologies;
3. demonstrate the difference between supervised, semi-supervised and unsupervisedlearning;
4. demonstrate proficiency in machine learning workflow and how to implement the steps

effectively;

5. explain natural languages, knowledge representation, expert systems and pattern recognition;
6. describe distributed systems, data and information security and intelligent web technologies;
7. explain the concept of big data analytics, purpose of studying it, issues that can arise with a data set and the importance of properly preparing data prior to a machine learning exercise; and
8. explain the concepts, characteristics, models and benefits, key security and compliance challenges of cloud computing.

Course 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.

GET 399: Students Industrial Work Experience II (3 Units C: 12 weeks)

Learning Outcomes

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

1. demonstrate proficiency in at least any three softwares in their chosen career choices;
2. demonstrate proficiency in some animation videos (some of which are free on YouTube)in their chosen careers;
3. carry out outdoor hands-on construction activities to sharpen their skills in their chosen careers;,
4. demonstrate proficiency in generating data from laboratory analysis and develop empiricalmodels;
5. demonstrate proficiency in how to write engineering reports from lab work;
6. fill logbooks of all experience gained in their chosen careers; and
7. write a general report at the end of the training.

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

Course Contents

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

activities and experiences to which students are expected to be exposed to earn prescribed credits include:

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

Section B: Mechanical design with computer graphics and CAD modelling and drafting. Introduction to Solidworks: software capabilities, design methodologies and applications. Basics part modelling: sketching with SolidWorks, building 3D components, using extruded Bose base · Basic assembly modelling, and solidWorks drawing drafting. Top-down assemblytechnique 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.

EEE 311: Electric Circuit Theory I (2 Units E: LH 30)

Learning Outcomes
Students will be able to:

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

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

EEE 321: Analogue Electronic Circuits I (2 Units C: LH 30)

Learning Outcomes
Students will be able to:

1. classify, describe and discuss the principles of operation and applications of FET and BJT;and
2. calculate amplifier parameters; and design simple amplifiers using BJT and FET with given specifications.

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.

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

Learning Outcomes
Students will be able to:

1. classify, describe and discuss the various logic gates and flip-flops and multivibrators;
2. design simple logic and sequential circuits using logic gates and flip-flops.

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.

EEE 324: Electromagnetic Fields and Waves I (2 Units E: LH 30)

Learning Outcomes
Students will be able to:

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

Course Contents
Review of electromagnetic laws in integral form, Gauss's Law, Ampere's and Faraday's Laws.Electrostatic fields due to distribution of charge. Magnetic fields in and around current carrying conductors. Time-varying magnetic and electric fields. Conduction and displacement current. Maxwell's equations (in rectangular co-ordinates and vector-calculus notation). Derivation of Maxwell's equations, electromagnetic potential and waves. Poynting vector, boundary conditions. Wave propagation in good conductors, skin effect; plane waves in unbounded dielectric media.

EEE 326: Electric Circuit Theory I (2 Units E: LH 30)

Learning Outcomes

1. At the end of the course, students will be able to:
2. analyse on-linear circuits using approximation methods;
3. state the conditions for realisability of transfer functions;
4. design/synthesize RL, RC, LC and RLC circuits from given transfer functions; and
5. design passive and active filters from transfer functions and performance specifications.

Course Contents

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

PAU-EEE 308 Data Communications and Networks (2 Units Required; L = 30)

Learning Outcomes

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

1. describe the rudiments of how computers communicate and the theoretical fundamentals of how the Internet works;
2. demonstrate knowledge and compare the architecture of a number of different network topologies and transmission media;
3. explain the fundamental principles of data communication across the layers of the OSI model;
4. evaluate and compare the various protocols in each layer of the OSI model
5. analyse and compare some standardized and popular networks such as Ethernet and WiFi;
6. identify and design algorithms and functionalities that allows reliable data transport over an unreliable network; and
7. demonstrate client-server applications using hardware such as end systems, switches and routers and software such as Cisco Packet Tracer and Wireshark.

Course Contents

Introduction to network edge, end systems, access networks, links and network core. Packet switching. Circuit switching. Network structure. Throughput in networks. Protocol layers. Application Layer. Web and HTTP. Electronic mail. Domain Name System. Video streaming and content distribution networks. Socket programming with UDP and TCP, Transport Layer, multiplexing and de-multiplexing. Connectionless transport: UDP, principles of reliable data transfer. Connection-oriented transport: TCP, principles of congestion control, TCP congestion control. Network layer: The Data Plane, control plane. Router architecture. IP: Internet Protocol. Generalised Forward and SDN. Network Layer: The Control Plane, routing protocols.

PAU-EEE 310 Electric Machines (2 Units Required; L = 30)

Learning Outcomes/

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

1. To know the general fundamentals of electrical machines.
2. Understand the principle of operation of electric machines (transformers, induction motors, synchronous generators)
3. Analyze the steady-state equivalent circuits of alternating-current, rotating electric machines.
4. Understand the operation of rotating machines as a motor and generator.
5. Analyze the main characteristics of each type of electric machine in different applications.
6. Evaluate and solve problems related to the main electrical machines (transformers, electromagnets, induction machines, synchronous machines, etc.).
7. analyse different types of DC generators and motors, their characteristics, industrial applications, effect of armature reaction and its assessment; and
8. explain the principle of DC motor, electrical characteristics and industrial application, purpose of starter and its design.

Course Contents

Introduction to machinery principles. Magnetic fields. Rotating magnetic field. Magnetomotive force and flux distribution in AC machines. Faraday's law–induced voltage from a time-changing magnetic field. Production of induced force on a wire. Induced voltage on a conductor moving in a magnetic field. Transformers. Types and construction of transformers. The ideal transformer. Theory of operation of real single-phase transformers. The equivalent circuit of a transformer. Transformer voltage regulation and efficiency. Three phase transformers. Transformer tests and vector groups. Synchronous generator construction and principle of operation. Equivalent circuit and phasor diagrams of synchronous generators. Power and torque in synchronous generators.

PAU-EEE 311 Electromechanical Systems (2 Units Required; L=30;)

Learning Outcomes

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

1. illustrate magnetic circuits and the basic principles of relays and actuators;
2. demonstrate the principle of operation, construction, selection, and application of circuit breakers, contactors, overload and timing relays, and fuses;
3. demonstrate DC machine operations and characteristics; contraction, excitation, torque-speed etc.;
4. illustrate the theory and operation behind AC machines and the production of rotating magnetic field;
5. describe the three-phase induction motor and the various characteristics;
6. identify the various starting methods for induction motors; and
7. classify machine selections for practical applications.

Course Contents
Magnetic circuits overview. Fuses (including short circuit definitions; operational classes; types; and sizing). Overload relays (Characteristic tripping curve; trip class; ambient temperature compensation; forms of operation; and sizing). Contactors (features; ratings; etc.). Auxiliary relays. Time relays (on-delay; off-delay, etc.). Monitoring relays. Circuit breakers and their classification. Principle of operation of various circuit breakers. Applications of various circuit breakers. D.C. machine construction. Characteristics of D.C. generators. Excitation of D.C. machines. Torque-speed characteristics of D.C. motors. A.C. machines. Production of rotating magnetic fields. Simple theory of three-phase induction motors. Torque speed characteristics. Three-phase induction motors. Starting methods for induction motors.

PAU-EEE 312 Laboratory Practical II (2 units, Required: PH = 90)

Learning outcomes
On completion of this course, students will possess the ability to:

1. design a local area network (LAN) and construct various logic gates, combinational, sequential and digital integrated circuits using a breadboard;
2. apply basic measurement and testing techniques using oscilloscopes and multimeters;
3. demonstrate proper logging of network cable and safe handling of crimping tool;
4. use software tools to simulate topologies and circuits; and
5. demonstrate troubleshooting and debugging skills to identify and resolve circuit and network issues.

Course content
Safety considerations. Making Straight-Through Ethernet Cables. PC Network TCP/IP Configuration. Working on a Star Network. Working on Hub and Switch Driven Star Networks using the Packet Tracer software. Connecting LANs with a Router. Implementation of Static Routing. Configuration of DHCP Servers in Client-Server Networks. The Wireshark Network Analyzer and the HTTP GET/response interaction. Number Systems and Codes. Boolean algebra and truth table. Switching circuits. Electronic logic gates. Combinational logic circuits. Computer-aided minimization of switching functions. Digital vs. analogue systems. Mixed signal design, analogue and digital grounding. Digital system design hierarchy. Logic devices: TTL and CMOS families, technology, applications. Memory devices. Latches, Flip- flops. Modular Design. Decoders. Implementing Logic Functions Using Decoder. Encoder Circuit Structures. Multiplexer circuits.

PAU-EEE 313 Laboratory Practical I (2 units, Required: PH = 90)

Learning outcomes

On completion of this course, students will possess the ability to:
1. produce motor control panels and construct basic circuits using a breadboard;

2. use various electromechanical, passive and active components, such as resistors, capacitors, transistors, operational amplifiers, solenoids, relays, contactors, timers, etc. and their combination to form different analogue and motor control circuits;
3. demonstrate basic measurement and testing techniques using oscilloscopes, multimeters, insulation resistance testers, and tachometers;
4. evaluate and design circuits such as amplifiers, direct on-line, star-delta, forward-reverse, etc.;
5. use software tools to simulate circuits, allowing for the modelling and testing of circuits prior to construction; and
6. demonstrate troubleshooting and debugging skills to identify and resolve circuit issues.

Course content

Overview of circuit analysis, diodes and rectifier circuits (Silicon diodes in AC circuits. Filtering and regulation of pulsating DC. Voltage (multiplying using Diodes and capacitors). General introduction to transistors. Bipolar Junction Transistors (BJT) and Characteristics. Common-Collector Circuit (Emitter Follower). Common-Base Circuit. Collector-to-Base Bias. Field Effect Transistors (FET). Types and Characteristics of FET. FET Bias Circuits: Gate Bias, Self-Bias and Voltage Divider. Basic JFET Circuits: Common-Source and Common-Drain. Darlington Pair Circuit. Cascaded stage of amplification. Classes of amplifiers. Class A single ended loudspeaker Driven audio amplifier. Operational Amplifiers. Complementary-symmetrical push pull output circuits. FET: common source amplifier. Comparators. Oscillators circuits. Implementation of the Logic Gates using e-MOSFETs. Fundamental of electromechanical system and components. Types of electric motors and characteristics. Protection for electric motors. Identification and sizing of circuit breakers and contactors. Identification and selection of relays and contactors. Methods of starting electric motors. Forward-reverse circuit design. Design, implementation and troubleshooting of circuit that solves industrial and environmental problems.

400 Level

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

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

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

Course 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 Departmentfor overall assessment.

PAU-EEE 401 Professional Ethics for Engineers (2 Units C; L = 30)

Learning outcomes
On completion of the course, students should be able to:

1. identify the importance of professional ethics in engineering practice;
2. demonstrate an understanding of the ethical responsibilities of engineers and their role in society;
3. identify the impact of professional ethics on engineering decisions;
4. identify methods of resolving ethical dilemmas;
5. explain ethical principles when making decisions in engineering;
6. demonstrate an understanding of the professional codes of conduct and standards of practice for engineers;
7. demonstrate an understanding of the legal and regulatory responsibilities of engineers
8. describe a framework for making ethical decisions in engineering.

Course Content
Introduction to Professional Ethics. Fundamentals of Engineering Ethics. Ethical Decision Making. Ethical Theories and Philosophies. Codes of Ethics and Professionalism. Engineering Responsibility and Accountability. Technological Hazards and Risks. Environmental Responsibilities. Social and Cultural Considerations. Professionalism and the Role of the Engineer. Intellectual Property Rights. Conflict of Interest. Engineering Practice and the Law. Responsible Use of Technology. Engineering in the Global Economy. Engineering Communication and Documentation. Professionalism in the Workplace. Professionalism in the Community. Ethical Challenges of the Digital Age. Case Studies in Professional Ethics

PAU-EEE 403 Principles of Communication Engineering (2 Units R; L= 45)

Learning Outcomes
On completion of the course, students should be able to:

1. compare the known different types of modulations techniques and identify the limitations in their application;
2. explain at least five broadcast bands and specifications of different modulation techniques;
3. describe, using block diagrams, the evolution of TV systems and prescribe three modulation technique for different broadcast scenarios;
4. explain all fixed line telephony systems, including access, multiplexing and signalling;
5. explain all mobile telephony systems, mobility management and network dimensioning;
6. discuss on the evolution of wide area packet data networks, including Internet Protocol and ATM;
7. demonstrate satellite voice communications and 3G to 5G mobile systems; and
8. demonstrate at least four interactions of commercial interests and technology standards.

Course Contents
Modulation. Reasons for modulation. Types of modulation. Amplitude modulation systems: Comparison of AM systems, Methods of generating, and detecting AM, DBS, SSB signals. Frequency mixing and multiplying, frequency division multiplexing, applications of AM systems. Frequency modulation systems: Instantaneous frequency, frequency deviation, modulation index. Bessel coefficients. Significant sideband criteria. Bandwidth of a sinusoidally modulated FM signal. Power of and FM signal. Narrowband FM, direct and indirect FM generation. Various methods of FM demodulation. Discriminator. Phase-lock loop. Limiter. Pre-emphasis and de-emphasis. Stereophonic FM broadcasting. FM broadcast band specification. Block diagram of FM radio receiver.

PAU-EEE 405 Electric Power Systems (2 Units R; L= 30)

Learning Outcomes
On completion of the course, students should be able to:

1. identify and describe at least five types of power stations as regards operation characteristics and economics;

2. describe the power supply economics and tariffs assessments;
3. explain and apply the polyphase theory to AC and DC Power distribution systems;
4. demonstrate the design principles of the various overhead line conductor types;
5. explain all the line compensation techniques as applied in reactive power – voltage control and active power flow control; and
6. demonstrate the mathematical models of interconnected electrical power networks.

Course Contents

Types of power station, operation, auxiliaries, economics of operation - stations, substations power supply economics, tariffs, Power factor correction. Polyphase theory. DC, AC power distribution, network calculations. Overhead line conductors. Corona effect, voltage control, circuit breakers, load forecast, sitting of generating plants. Second phase of investigations involving the implementation of the designed model, debugging, calibration, testing, data collection and analysis, and presentation of a comprehensive written report of the investigations. Overview of modern power systems. Review of single and three-phase AC networks. Representation of synchronous machines for stability analysis. Principles of power and frequency control. Principles of reactive power and voltage control. Steady-state performance using load-flow analysis. Network fault analysis. Small and large-signal rotor-angle stability analysis. Principles of power system protection.

PAU-EEE 407 Introduction to Control Systems Engineering (3 Units R; L = 45)

Learning Outcomes

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

1. describe different linear and non-linear control systems;
2. analyse the common responses and stability scenarios inherent in closed and open loop systems;
3. describe alternate representations of dynamic systems (time domain, frequency domain, state space);
4. demonstrate and apply the basic block diagram representations of control systems and design PID controllers based on empirical tuning rules;
5. describe Evans root locus techniques in control design for real world systems;
6. demonstrate the stability of systems by root locus and frequency response methods;
7. compute gain and phase margins from Bode diagrams and Nyquist plots and understand their implications in terms of robust stability; and
8. demonstrate Bode diagrams, root locus graphs and Nyquist plots for the analysis of control systems solve numerical problems on control systems.

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– Mass-Dashpot 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 tacho-generators. Actuators.

PAU-EEE 409 Power Electronics (2 Units R; L=30)

Learning outcomes

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

1. identify the fundamentals of power electronics, including technologies, components, and topologies used in power conditioning systems;
2. identify power electronic converter characteristics and analyse static and dynamic operation;
3. demonstrate the design DC-DC converters, rectifiers, invertors, and power supplies;
4. identify protection and control techniques for power electronic converter-based systems;
5. describe applications of power electronics in fields such as renewable energy systems, electrical vehicles, grounding systems, etc.;
6. identify issues such as power quality, and harmonics and anti-harmonic techniques; and
7. demonstrate the use of semiconductors and integrated circuit technology in power electronics.

Course content
Introduction to Power Electronics (definition, history, applications). Principles of Motor Control. DC to DC Converters and Regulators. AC to DC Power Converters. AC to AC Power Electronic Systems. Chopper and Inverter Circuits. DC Power Systems. Induction Motor Drives. Thyristor Circuits and Switches. Design of Power Supply and Control Circuits. Heat Sinks and Thermal Management. Modelling and Simulation of Power Electronic Systems. Power Quality Control. Resonant Conversion Topologies. Signal Processing of Power Converters. Multi-level Inverters. Power Modules. Power System Control and Automation. Modern Control Techniques. Non-linear Control of Power Converters.

PAU-EEE 411 Laboratory Practical III (2 units, R: P = 90)

Learning outcomes
On completion of this course, students will possess the ability to:

1. construct, configure and run VSDs and soft starters;
2. demonstrate the usage of various tools used in telecommunications and transformer testing;
3. use basic measurement and testing techniques using multimeters, insulation resistance testers, and tachometers;
4. evaluate and design circuits for telecommunication, and motor control drives; and
5. demonstrate troubleshooting and debugging skills to identify and resolve circuit issues.

Course content
Safety considerations. Introduction to Variable Speed Drives (VSD) and soft starters. Components of VSD. Types of motor drives. Choosing the right motor drives. Constant torque. Variable Torque. 2 wire control. 3 wire control. VSD programming. Uploading and downloading parameters. Hardware

configuration. VSD testing. Design, implementation and troubleshooting of circuit that solves industrial and environmental problems. Introduction to transformers, Transformer testing. Testing equipment. Troubleshooting. Introduction to telecommunication. Network design. Signal transmission. Analog and digital signalling techniques. Signal modulation and demodulation. Amplitude modulation (AM). Frequency modulation (FM). Phase modulation (PM). Pulse-code modulation (PCM). Network security. Error detection and correction. Encoding, and multiplexing.

PAU-EEE 413 Engineering Economics (2 Units Core; L = 45)

Learning outcomes
On completion of the course, students should be able to:

1. describe the common fundamentals of engineering economics, including the principles of capital budgeting, cash flow analysis, and cost-benefit analysis;
2. identify and evaluate the basic economic and financial alternatives in engineering projects;
3. describe at least five risks and uncertainties associated with engineering projects;
4. compute financial calculations, like present worth, annual worth, and future worth analysis;
5. demonstrate an understanding of decision-making techniques such as cost-benefit analysis, sensitivity analysis, and optimisation;
6. compare various principles of engineering economics to projects in a variety of engineering disciplines;
7. describe the differences between economic and financial feasibility of engineering projects;
8. demonstrate an understanding of the impact of taxation on engineering projects; and
9. identify local and international standard practices as regard ethical and social considerations when making engineering economic decisions.

Course content

Introduction to Engineering Economics. Cost Estimation and Analysis. Cash Flow Analysis. Pricing and Capital Investment Decisions. Engineering Economics in Decision Making. Break-Even Analysis. Risk Analysis and Uncertainty. Depreciation. Taxation. Life-Cycle Cost Analysis. Project Evaluation and Selection. Replacement Decisions. Inflation and Interest Rates. Cost-Benefit Analysis. Cost Control and Optimisation. Sensitivity Analysis. Economic Feasibility of Projects

PAU-EEE 402 Industrial Automation (Electro-pneumatics & Programmable Logic Controls PLC) (2 Units R; L = 15; P = 45)

Learning outcomes

On completion of this course, Student should be able to:

1. identify the characteristics of manufacturing processes, assembly and material handling operations that lend themselves to automation vs. manual operation\
2. determine if the automation should be fixed, programmable, or flexible
3. demonstrate proficiency in the selection and use of sensors, actuators, interface devices, and process controllers for automation devices and process control

4. for tasks described in prose, generate ladder logic for programmable logic controllers (PLCs), and demonstrate the performance of automation and control systems using PLCs
5. specify, select, wire and plumb electro-pneumatic devices, circuits and systems for automation
6. demonstrate knowledge of safety issues in the design and use of automation devices and systems

Course content

Introduction to sensor. Identification of types of sensors. Limit switches (theory of operation and application). Magnetic proximity sensor (theory of operation and application). Inductive proximity sensors (theory of operation and application). Capacitive proximity sensor (theory of operation and application). Ultrasonic proximity sensors (theory of operation and application). Photo-electric proximity sensors (theory of operation and application). General application of sensors. Introduction to pneumatics. Introduction to the Electric ladder diagram. Ladder diagrams. Electro- pneumatic Components. Solenoid valves. Control of actuators. Latching electrical signals. Application of logic controls in electro-pneumatic systems. Introduction to programmable logic control (PLC). Review of number system. Base requirement. Connecting external devices. Discreet input and output. Analog input and output. Timers. Counters. Programming and troubleshooting in a PLC system.

GET 402 Engineering Project I (2 Units: C; PH 90)

Learning Outcomes

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

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

Course Contents

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

GET 404 Engineering Valuation and Appraisal (2 Units C; L=30)

Learning outcomes

1. On completion of the course, students should be able to:
2. demonstrate an understanding of the different methods used to value and appraise engineering assets;

3. describe engineering valuation and appraisal techniques to calculate the monetary value of engineering assets;
4. identify the economic, social, environmental and legal considerations when conducting an engineering valuation and appraisal;
5. describe the depreciation methods and the impact of inflation on engineering valuation and appraisal;
6. identify the different stakeholders involved in engineering valuation and appraisal and their interests;
7. describe the role of engineering valuation and appraisal in strategic decision-making; and
8. demonstrate the skills necessary to present engineering valuation and appraisal results to a variety of stakeholders.

Course content

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

500 Level

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

Learning Outcomes

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

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

Course 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), riskanalysis, 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)

Learning Outcomes

Students will be able to:

1. describe and explain the basic concept, sources and aspects of law;
2. describe and explain the major differences between the various categories of law, courts and legal jurisdictions;
3. describe and explain legal principles and their application in professional engineering design and management services and their professional liability implications; and

4. develop reasoned analysis of real-life or hypothetical engineering scenarios using the legal principles undertake critical analysis of reliable information to develop, and practically present technical reports for use in varying judicial/quasi-judicial settings including as an expert witness.

Course 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 oftorts: definition, classification and liabilities. Patents: requirements, application, and infringement. Registered designs: application, requirements, types and infringement. Company law. Labour law and Industrial Law. Business registration.

EEE 593/594: Final Year Project (6 Units C: LH 270)

Learning Outcomes

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

Course Contents

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

PAU-EEE 510 Engineering Management (2 Units C; L=30)

Learning outcomes

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

1. demonstrate an understanding of the principles and practices of engineering management and their application to the management of engineering projects;
2. identify, analyse, and resolve engineering management problems;

3. describe the role of engineering management in the design, development, and implementation of engineering projects;
4. demonstrate skills in problem solving, decision making, and systems thinking;
5. describe the role of engineering management in the global economy; and
6. demonstrate skills in leading and managing engineering teams.

Course content

Principles of Organisation; elements of organisation; management by objectives. Financial management, accounting methods, financial statements, cost planning and control, budget and budgetary control. Depreciation accounting and valuation of assets. Personnel management, selection, recruitment and training, job evaluation and merit rating. Industrial Psychology. Resource management; contracts, interest formulae, rate of return. Methods of economic evaluation. Planning decision making; forecasting, scheduling. Production control. Gantt chart, CPM and PERT. Optimisation linear, materials handling. Raw materials and equipment. Facility layout and location. Basic principles of work study. Principles of motion economy. Ergonomics in the design of equipment and process.

PAU-EEE 506 Digital Signal Processing (2 Units E; L = 30)

Learning outcomes

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

1. state at least three fundamentals of sampling and quantisation of signals;
2. demonstrate skills to analyse the time and frequency response of digital systems;
3. describe the operation and three designs of digital filters;
4. demonstrate an understanding of at least two principles of digital modulation;
5. identify the performance of various digital modulation techniques;
6. demonstrate an understanding of the principles of digital signal processing;
7. demonstrate an understanding of the principles of image processing; and
8. identify the various fundamentals of digital signal processors (DSPs).

Course content

Introduction to Digital Signal Processing. Discrete-Time Signals and Systems. Discrete-Time Fourier Analysis and Transformations. Z-Transform and Discrete-Time Systems. Digital Filter Design. Digital Processing of Random Signals. Digital Signal Processing Architectures. Multi-rate Digital Signal Processing. Adaptive Filtering and Signal Processing. Speech Processing. Image Processing. Video Processing. Biomedical Signal Processing. Fractional Fourier Transform. Wavelets and Discrete-Time Processing. Estimation Theory and Algorithms.

PAU-EEE 512 Switchgear and High Voltage Engineering (2 Units E; L=30)

Learning outcomes

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

1. state the various fundamentals of switchgear, high voltage components, and circuit breakers;
2. identify the different types of switchgear and high voltage components and their characteristics;
3. identify at least four roles of switchgear in electric power systems;
4. demonstrate the design, construction, installation, and operation of switchgear and high voltage components;
5. identify the various skills in the use of advanced technologies related to switchgear and high voltage engineering;
6. demonstrate an understanding of the principles of electrical safety in the use of switchgear and high voltage components; and
7. describe the principles of protection and coordination of switchgear and high voltage components.

Course content

Introduction to Switchgear and High Voltage Engineering. Basics of Electrical Power System Components. Principles of High Voltage and Insulation Engineering. Protection of Power Systems. Switchgear and Circuit Breakers. Transformers and their Applications. Power System Studies. Design of High Voltage Systems. Power System Reliability and Economics. Overhead Lines and Underground Cables. High Voltage Testing. High Voltage Engineering Laboratory. Electric Power System Automation. Advanced Topics in Switchgear and High Voltage Engineering.

PAU-EEE 514 Digital Communications Systems (2 Units E; L = 30)

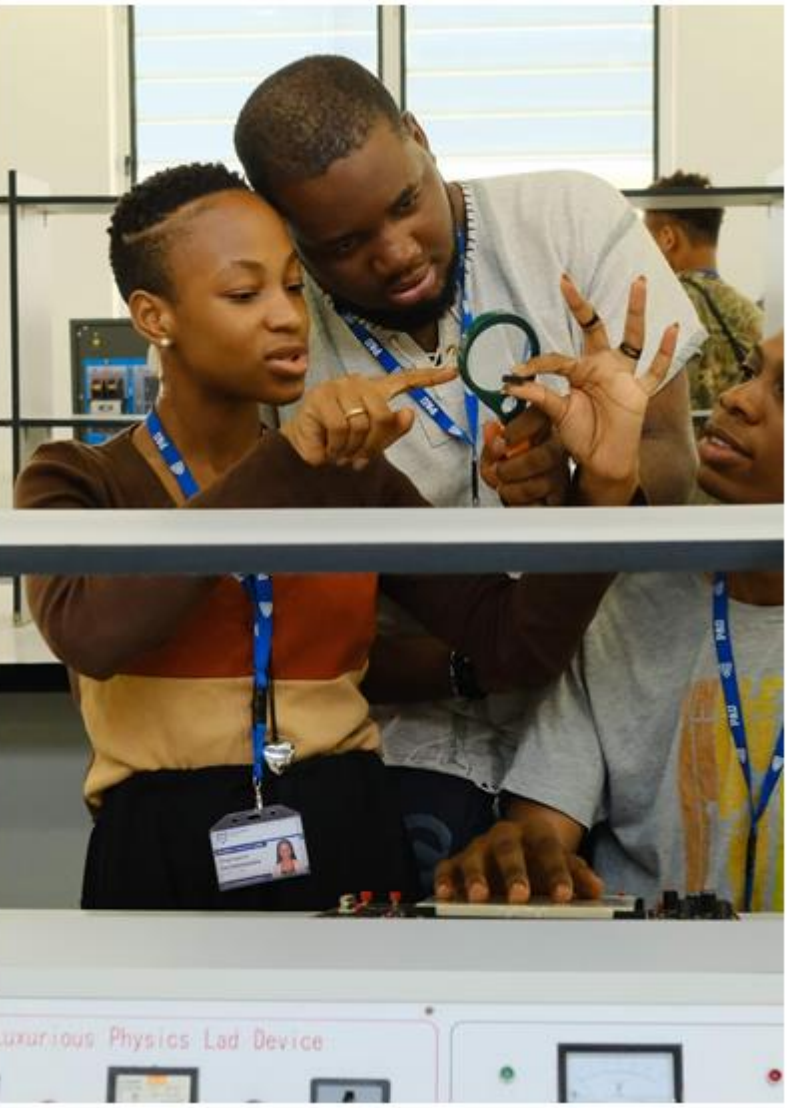
Learning outcomes

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

1. demonstrate various ways to simulate digital communication systems;
2. identify methods of modulation and coding used in digital communication systems;
3. identify most concepts of source and channel coding, and their applications in digital communication systems;
4. describe the principles of digital communication systems, including the physical layer and higher layers;
5. demonstrate an understanding of the principles of digital signal processing, including Fourier analysis and filter design;
6. demonstrate an understanding of wireless communication systems, including cellular systems, wireless LANs, and satellite communication; and
7. describe the principles of digital communication system performance, such as bit error rate and signal-to-noise ratio.

Course content

Introduction to Digital Communications. Basics of Digital Modulation. Source Coding. Channel Coding. Digital Transmission Techniques. Synchronisation Techniques. Multi-carrier Modulation. Digital Signal Processors. Digital Modem Technology. Introduction to Wireless Networks. Wireless Network Technologies. Fundamentals of Spread Spectrum Communications. Introduction to Satellite Communications. Introduction to Cognitive Radio Networks. Introduction to MIMO Systems. Introduction to Network Coding. Introduction to Network Security. Introduction to Cognitive Radio Networks.


uxurious Physics Lad Device