UNIVERSITY OF ILORIN, NIGERIA

FACULTY OF ENGINEERING AND TECHNOLOGY
DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

B.Eng. Electrical and Electronics Engineering
The Core Curriculum and Minimum Academic Standards for the Nigerian University System (CCMAS)

STUDENTS' HANDBOOK (UNDERGRADUATE)

2024

UNIVERSITY OF ILORIN, ILORIN, NIGERIA

BRIEF HISTORY

The University of Ilorin is one of the second-generation universities established by a Decree of the Federal Military Government in August 1975. It was initially an affiliated College of the University of Ibadan, known as the University College, Ilorin and attained full autonomous status as University in October, 1977. The University, which started with three (3) Faculties has grown in leaps and bounds to attain its present expansion to sixteen (16) Faculties. Starting with 200 students, the University presently has a total number of 50,833 students. The University runs and awards certificates in the following programmes: Diploma, Undergraduate Degree, Postgraduate Diploma, and Postgraduate Degree. In addition, the University currently has a total number of 3,652 staff members (both academic and non-teaching). The University, as part of its prowess as a citadel of learning, has won to its credit, several medals and awards in both academic and extra-curricular activities, nationally and internationally. The University of Ilorin emerged as the overall best institution at the Fourth Edition (2021/2022 – 2022/2023) of the Joint Admissions and Matriculation Board (JAMB) **NATIONAL TERTIARY ADMISSION PERFORMANCE- MERIT AWARD (NATAP-M)**.

MISSION STATEMENT
To provide a world-class environment for learning, research, and community service.

VISION STATEMENT
To be an International Centre of Excellence in learning, research, probity, and service to humanity.

MOTTO: Probitas Doctrina (Probity and Scholarship)

COLOURS: Deep Blue, Green, Golden, and White

MASCOT: Eagle Wide Span

PRINCIPAL OFFICERS OF THE UNIVERSITY

The Vice-Chancellor
Professor Wahab Olasupo Egbewole, *SAN*
LL.B (Hons) (Ile-Ife); B.L. (Lagos); LL.M (Ile-Ife); Ph.D. (Ilorin); *FCArb, Fspsp, fciml (USA), fnipr*
The Deputy Vice-Chancellor (Academic)
Professor Olubunmi Abayomi Omotesho
B.Sc., M.Sc., Ph.D. (Ibadan), *FNAE, FNAAE, fciml (USA)*

The Deputy Vice-Chancellor (Management Services)
Professor Sulaiman Folorunsho Ambali
DVM, M.Sc., Ph.D. (Zaria), *FSASS, FSEAN, fciml (USA)*

The Deputy Vice-Chancellor (Research, Technology & Innovation)
Professor Adegboyega Adisa Fawole
MB;BS (Ilorin), *FWACS, fciml* (USA)

The Registrar
Mr. Mansur Adeleke Alfanla
B.A. Comb. Hons. (Kano), LL.B. (Ilorin), B.L. (Abuja), LL.M. (Ilorin), *fciml (USA)*

The Ag. Bursar
Mr. Oba Abdulbarki
B.Sc. (ABU, Zaria), ACA

The University Librarian
Dr. Kamal Tunde Omopupa
B.A. (LS) (Kano), MILR (Ilorin), MLIS (Ibadan), Ph.D. (SA), *fciml (USA)*

FACULTY OF ENGINEERING AND TECHNOLOGY

History of the Faculty of Engineering and Technology

The Faculty of Engineering and Technology at the University of Ilorin was established in September 1978, with the primary objective of providing a robust institutional framework for training engineers capable of driving the technological development of Nigeria and the world. From its inception, the faculty has fostered a conducive environment for the education of undergraduate engineering students and has facilitated cutting-edge research activities among its academic staff. Over the years, the faculty has expanded its programs to include postgraduate training, offering master's and doctoral degrees in various engineering disciplines.

Departments and Growth

At its founding, the faculty started with three departments: Civil Engineering, Electrical Engineering, and Mechanical Engineering, alongside a Central Engineering Workshop, which was established in 1979 to provide hands-on training and practical experience to all engineering students. The faculty's academic and research programmes were designed to attract students with strong backgrounds in mathematics and physical sciences, with an emphasis on logical, imaginative, and creative problem-solving skills.

The faculty's commitment to academic excellence and research has led to the expansion of its programmes over the years. In 1982, the Department of Agricultural Engineering was established as the faculty’s fourth department. Subsequent additions include:

- Department of Chemical Engineering (2008/2009)
- Department of Materials and Metallurgical Engineering (2010)
- Department of Water Resources and Environmental Engineering (2013)
- Department of Computer Engineering (2014)
- Department of Biomedical Engineering (2015)
- Department of Food Engineering (2014/2015)

As of the 2020/2021 academic session, the Faculty of Engineering and Technology had grown to host 3,351 undergraduate students across its ten departments. The faculty has been led by a series of distinguished Deans since its inception. Below is a list of the past and present Deans:

1. Prof. V.O.S. Olunloyo (Mechanical Engineering, 1978-1980)
2. Prof. I.E. Owolabi (Electrical and Electronics Engineering, 1980-1984)
3. Prof. B.J. Olufeagba (Electrical and Electronics Engineering, 1984-1988)
4. Prof. S.O. Adeyemi (Civil Engineering, 1988-1990)
5. Prof. J.S.O. Adeniyi (Mechanical Engineering, 1990-1994)
6. Prof. F.L. Bello-Ochende (Mechanical Engineering, 1994-1998)
7. Prof. K.C. Oni (Agricultural and Biosystems Engineering, 1998-2001)
8. Prof. O.A. Adetifa (Civil Engineering, 2001-2005)
9. Prof. B.F. Sule (Civil Engineering, 2005-2009)
10. Prof. J.O. Olorunmaiye (Mechanical Engineering, 2009-2013)
11. Prof. Y.A. Jimoh (Civil Engineering, 2013-2017)
12. Prof. D.S. Ogunniyi (Chemical Engineering, 2017-2021)
13. Prof. O.A. Lasode (Mechanical Engineering, 2021-2023)
14. Prof. J.K. Odusote (Materials and Metallurgical Engineering, 2023-present)

The faculty has also benefited from the support of dedicated administrative staff, including several Senior Registry staff who have served as Faculty Officers. These officers play a crucial role in facilitating the activities of students from admission to graduation and supporting staff from recruitment to retirement. Notable present Faculty Officers include Mrs. Docars D. Adu, Muktar Lukman Abiodun, A.B. Shuaib, Oluseun Jolayemi, A.J. Anate, Abdulateef Bello, Hassana Adegbite, Dr. A.S. Alawaye, A.O. Shuaib, Grace A. Abajo, Mrs. Adeniyi, Adetola Oluwakemi, J.K. Omotosho, Mrs. Nimotallahi Ismail, Lamidi Helen and A.M. Adisa who currently serves in the role. The Faculty of Engineering and Technology hosts an annual international conference known as the Faculty of Engineering and Technology International Conference (FETiCON). Additionally, the Faculty publishes the Nigerian Journal of Technological Development, a Q4 journal indexed in Scopus and Scimago, which highlights research and innovations in engineering and technology.

The Faculty of Engineering and Technology continues to strive towards improving the quality of education and research offered to its students. Through regular curriculum reviews and a focus on innovative research, the faculty aims to remain at the forefront of engineering education in Nigeria and beyond, contributing to both national development and the global engineering community.

VISION:

To be a world-class Engineering and Technological centre for innovations in learning, research, probity and service to humanity.

MISSION:

To provide Engineering and Technological environment for learning, research and community services.

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

The Department of Electrical and Electronics Engineering was formally established in September 1978 as the Department of Electrical Engineering until the change of name in 2012 to the current name. The Department is built around a number of highly qualified and experienced staff. It seeks to attract students who have proven their academic capacity in mathematics, physics and chemistry, and who also exhibit logical thinking, creativity, curiosity, imagination, persistence and patience. The students must, in addition, possess a satisfactory command of verbal and written English Language.

The Department defines as its goal the production of Engineers who can function well in a broad range of professional activities such as teaching, research and development, design, manufacturing, testing and commissioning, maintenance, operation, marketing, sales and management. In order to achieve this, a comprehensive list of foundation courses must be taken and successfully completed before graduation. These courses, apart from mathematics and computer methods, include other engineering disciplines, sociology, ethics, etc.

As part of University regulations, which require a periodic review of the curriculum of every department, the Electrical and Electronics Engineering Department has undergone several reviews since inception.

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.

Objectives

The objectives of the programme are, among others, to:

1. apply knowledge of Science, Technology, Engineering and Mathematics (STEM) fundamentals to the solution of Electrical and Electronic Engineering related problems;
2. design solutions for Electrical and Electronic 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 and synthesis 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 effective

reports 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 human health and welfare and the environment in a global society; and
10. develop entrepreneurial skills and knowledge, in addition to adequate training in human and organisational systems with the spirit of self-reliance so that they can set up their own businesses.

Employability Skills

Electrical and Electronic Engineers to be produced are expected to be equipped, among others, with the following skills:

1. Define, investigate, and analyze electrical and other borderline engineering problems;
2. Design or develop creative and innovative solutions to electrical engineering and related problems;
3. Evaluate the outcomes and impacts of electrical and electronic engineering activities;
4. Take personal responsibility for making decisions on the part, or all, of electrical and electronics engineering activities;
5. Initiate, plan, lead or manage electrical and electronic and related engineering activities;
6. Exercise sound judgment in the course of his/her work;
7. Communicate efficiently, honestly and effectively with others in the course of his engineering work; and
8. Develop and operate within a hazard and risk framework to evaluate outcomes and impacts of electrical and electronic engineering activities.

21st Century Skills

The programme has emphasised the following 21st century skills:

1. problem solving;
2. collaboration (team work);
3. digital literacy;
4. creativity and innovation;
5. information literacy; and
6. critical thinking through collaborative research projects and group assignments.

Unique Features of the Programme

Electrical and Electronic Engineering is at the core of the modern world, from power systems, computers to digital circuits, photonic and a wealth of electrical and electronic devices. This programme offers a unique combination of complementary knowledge and skills in electrical power systems, electronic and 21st century skills in artificial intelligence (AI), machine learning (ML), big data, et cetera, thus allowing graduates to pursue a wide range of engineering interests and strategic career choices. The programme will produce graduates with knowledge to provide society with the complex electrical and electronic systems, as well as the software and hardware needed or required to operate the systems. Unlike the earlier curriculum, this one is more student-centered to unleash their power of self-confidence and critical thinking.

Special Job Opportunities of the Programme

Electrical and Electronics Engineers are involved in the design and development of electrical and electronic equipment and in the improvement of the capabilities of existing electrical and electronic equipment. There is a gamut of very broad opportunities for electrical and electronic engineers. They can also find themselves in software companies involved in the design, manufacture and operation of various engineering devices. The career scope in this field at both national and international levels is excellent.

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

Job Title	Job Description
Design Engineer	Development of ideas for new products and the systems used to manufacture them. Such systems include consumer electronics (TV, VCRs, CD players, stereo equipment, gaming devices); power generation, transmission and distribution; computer equipment (motherboards, printers, scanners, processors, monitors); communications equipment (transmitters and receivers, networks)
Electronic Engineer	Design and creation of everyday devices such as mobile phones and computers. Manufacturing Engineer Plant Engineering: servicing and offering support in industrial environment; Power Engineering: safe and reliable power delivery; Control Engineering: design, programming, support to industrial automation; Information Systems Engineering: support to manufacturing processes
Quality Control Engineer	Designing and overseeing the production of various types of complex systems and equipment.
Analysis and Test Engineer	Plan, design, and evaluate products, as well as collaborating with the production department. Technical Service Engineering: troubleshooting, maintenance and repair; Product Testing for quality, safety, performance of equipment
Software Engineer	Develop, test and improve systems and components including circuit boards, processors, and other devices. Project Engineer Planning, implementing, resource forecasting and other technical activities of the project.
System Design Engineer	To research, study and develop new ideas for new products and the system to manufacture them.
Research Engineer	Analysing, implementing and testing the product developed in the laboratory

Field/Sales Engineer	Technical Service Engineering: troubleshooting, maintenance and repair; Product Testing for quality, safety, performance of equipment
Research and Development (R&D)	Product Development; Research to discover/develop new technologies; Training.

Laboratories and Workshops

The following laboratory and workshop facilities are available in the department:

1. Applied Electricity Laboratory
2. Electronics Laboratory
3. Communication Engineering Laboratory
4. Computer Hardware Laboratory
5. Control Engineering Laboratory
6. Power & Machines Laboratory
7. Skill-G Laboratory
8. Electrical/Electronics Workshop

Also, in the Nigerian Liquified Natural Gas (NLNG) building, three laboratories are available for the department's use; these are:

1. Data Communication Laboratory
2. Computer Software and Hardware Laboratory
3. Energy Research & Wind Tunnel Laboratory
4. Instrumentation & Control Laboratory

There is also a Tertiary Education Trust Fund (TETFund) building where the department has the Electrical Power Laboratory.

In addition, the Department makes use of the University Central Workshop (housed in the Faculty of Engineering and Technology) for project fabrication as well as the University Central Research Laboratory.

Staff List of the Department

S/No	Name	Rank	Qualifications	Area of Specialization
1	A. I. Abdullateef	Reader/ Ag. Head	B.Eng., (OSUA); M.Eng. (UNIBEN); Ph.D. (IIUM, Malaysia); MNSE; R.Engr.	Electrical Power Systems & Machines
2	G.J Kolo	Professor	B.Eng., (ABU); M.Eng. (UNILAG), Ph.D. (UN, Malaysia), MNSE, R.Engr.	Electronics & Telecommunications
3	Nazmat. T. Surajudeen-Bakinde	Professor	B.Eng., M.Eng. (UNILORIN), Ph.D. (UOL, Liverpool, UK), MIEEE, MNSE, R.Engr.	Electronics & Telecommunications
4	A. Y. Abdulrahman	Professor	B.Eng., M.Eng. (UNILORIN), Ph.D. (UTM, Malaysia); MNSE, MIEEE; IELTS, R.Engr.	Electronics & Telecommunications
5	I. O. A. Omeiza	Reader	B.Eng., M.Eng., Ph.D. (UNILORIN), MNSE, R.Engr, MIEEE	Telecommunications (Signal Processing)
6	O. Ibrahim	Reader	B.Eng. (UNILORIN), M.Eng. (GCU, Glasgow UK), Ph.D. (UTP, Malaysia), R.Engr.	Electrical Power Systems & Machines
7	A. O. Otuoze	Senior Lecturer	B.Eng. (UNILORIN), M.Eng. (UNIBEN), Ph.D. (UTM, Malaysia); MIEEE, R.Engr.	Electrical Power Systems & Machines
8	A. S. Afolabi	Senior Lecturer	B.Eng., M.Eng. (UNILORIN), Ph.D. (Kobe, Japan), R.Engr.	Electronics & Telecommunications
9	J. Akanni	Senior Lecturer	B.Eng., M.Eng., PhD (UNILORIN), MIEEE, MNSE, R.Engr.	Electronics & Telecommunications
10	O. O. Mohammed	Senior Lecturer	B.Eng. (BUK), M.Sc. (Coventry, UK), Ph.D. (UTM, Malaysia); MIEEE, MNSE, R. Engr.	Electrical Power Systems & Machines
11	O.S. Zakariyya	Senior Lecturer	B.Eng. (ABU); M.Sc. (EMU, Famagusta, Cyprus); PhD (ABU); R.Engr.	Electronics & Telecommunications
12	Temitope O. Fajemilehin	Lecturer I	B.Sc. (OAU); M.Eng. (UNILORIN); Ph.D. (PAUSTI/JKUAT, Kenya); MNSE, R.Engr.	Electronics & Telecommunications
13	C. A. Adamariko	Lecturer I	B.Eng., M.Eng. (UNILORIN), R. Engr.	Electronics & Telecommunications
14	Joy. B. Ogunsakin	Lecturer I	B.Eng., M.Eng., Ph.D. (UNILORIN); MIEEE, R.Engr.	Computer and Control
15	A. M. Usman	Lecturer I	B.Eng., M.Eng., (UNILORIN), MNSE, MIEEE, R.Engr.	Electronics & Telecommunications
16	S.A. Olayanju	Lecturer I	B. Tech, M. Tech (LAUTECH), MNSE, R. Engr.	Electronics & Telecommunications

17	O. Oniyide	Lecturer II	B.Eng., M.Eng. (UNILORIN)	Computer and Control
18	R.A. Alao	Lecturer II	B.Eng. (UNILORIN), M.Eng. (UNIBEN)	Electrical Power Systems & Machines
19	K. O. Osunsanya	Assistant Lecturer	B.Eng. (OSUA); MSc. (UNILAG); M.Eng., (UNIBEN); MNSE	Electronics & Telecommunications
20	M.S. Sanusi	Senior Lecturer	BTech (Ogbomoso), MSc, Ph.D. (Ibadan)	Food Engineering and Product Development
21	Y. L. Shuaib Babata	Professor	BEng, MSc, (Ilorin); Ph.D. (MINNA)	Casting technology, Corrosion, Materials Characterization, Manufacturing, Design and Fabrication
22	K. O. Yusuf	Professor	BEng (Minna); MEng (Ilorin), Ph.D. (Ilorin)	Soil and Water Engineering
23	T.A. Ishola	Reader	BEng, MEng, (Ilorin); Ph. D. (UPM)	Food Machine Design and Automation
24	E.O. Ajala	Reader	BTech, (Ogbomoso), MSc. (Ife), Ph.D. (Minna)	Biochemical Engineering
25	J.A. Adeniran	Reader	BTech (Ogbomoso); MSc (Lagos); Ph.D. (Ogbomoso)	Environmental Engineering, Climate Change
26	A.G. Adeniyi	Reader	BTech, MTech, Ph.D. (Ogbomoso)	Process System Engineering, Process and Product Development
27	H. U. Hambali	Senior Lecturer	BEng (Maiduguri); MSc (Zaria); Ph.D. (UTM, Johor Bahru)	Catalysis of Petrochemicals production and Wastewater treatment
28	Mary A. Ajala	Senior Lecturer	BTech; MTech; (Ogbomoso); Ph.D. (Minna)	Environmental Engi neering
29	M. O. Iyanda	Senior Lecturer	BEng, MEng, Ph.D. (Ilorin),	Farm Power
30	A.B. Rabiu	Senior Lecturer	B.Eng (Kano), MEng, Ph.D. (Ilorin)	Thermo fluid
31	O.T. Popoola	Senior Lecturer	B.Eng (Kano), MEng, Ph.D. (Ilorin)	Thermo fluid
32	Zainab T. Yaqub	Lecturer I	BSc, (Lagos); MTech, (Johannesburg); Ph.D. (Johannesburg)	Biochemical Engineering
33	M.A. Amoloye	Lecturer I	BEng (Bauchi); MTech (Ogbomoso); Ph.D. (Ilorin	Process System Engineering, Process

				and Product Development
34	I. N. Aremu	Lecturer I	MSc, (Ukraine)	Iron and Steel Making, Materials Characterization
35	Y. O. Babatunde	Lecturer I	BEng, MEng. (Ilorin), Ph.D. (PAUSTI, Kenya)	Structures

Non-Administrative Staff

S/No	Name	Rank	Qualification
1	Engr. B. Ekwemuka,	Principal Chief Technologist	HND, PGD, M.ENG, MNSE, R.Engr.
2	Engr. M. O Arowolo	Principal Chief Technologist	HND, PGD, MNATE, R.Engr.
3	Engr. B. O Ariyo	Assistant Chief Technologist	HND, PGD, B.Eng., M. Eng., MNSE, R.Engr.
4	Mr. Oyeyiola, Abdulhamid Kolawole	Principal Technologist	B. Eng, M. Eng.
5	Engr. D. K Mohammed	Principal Technologist	HND, PGD, M. Sc. (Inf. Tech.), R.Engr.
6	Mr. Ahmed, Olatunji	Senior Technologist	HND, PGD (Education), MNATE
7	Mr. Alausa, Abdulkadir	Technologist II	B.Eng.
8	Mr.A.A. Chindo	Technologist I	B.Eng.
10	Mr. Raheem, Mohammed Toyin	Senior Workshop Superintendent	WAEC, Intermediate Cert Advanced Tech. Diploma, level 3 IVQ technician diploma, level 5 IVQ Advanced technician diploma.

Administrative Staff

S/No	Name of Staff	Rank	Qualification
1	Anifowose, Kuburat	ND	Chief Secretarial Assistant

Head of the Department

Dr. A.I Abdullateef (2023 to date)

3.4.2 Past Heads of the Department

Professor I. E. Owolabi - 1978 – 1980 & 1986 - 1989
Professor A. K. Yesufu - 1980 - 1981

Professor B. J. Olufeagba`	-	1981 – 1984 &1993 - 2000
Dr. A. Esan	-	1985 – 1989
Dr. N. Smart-Yeboah	-	1989 - 1991
Dr. T. S. Ibiyemi	-	1991 - 1992, 2000 – 2002 & 2005 - 2007
Mr. V. S. Adeloye	-	1992 – 1993 (Coordinator)
Professor B. J. Olufeagba	-	1993 - 2000
Dr. S. A. Aliu	-	2002 – 2005 & 2007 - 2010
Engr. S. A. Saleeman (Coordinator)	-	Jan. 2010 – March 2010
Engr. Dr. Y. A. Adediran	-	2010 - 2011
Engr. Professor Y. A. Adediran	-	2011 - 2013
Engr. Dr. I. O. A. Omeiza	-	2013 - 2015
Engr. Dr. M. F. Akorede	-	2015 - 2017
Engr. Dr. (Mrs.) N. T. Surajudeen-Bakinde	-	2017 -2019
Engr. Dr. A. Y. Abdulrahman	-	2019 – 2022
Professor. M. F. Akorede	-	2022 – 2023

Administrative Responsibilities in the Department

1. Head of Department
2. Postgraduate Programme Coordinator
3. Examination Officer
4. Final Year Project Coordinator
5. SIWES Representative
6. SWEP Representative
7. COBES Representative
8. Level Advisers (100L – 500L)
9. Departmental Librarian

B.Eng. Electrical and Electronics Engineering

COURSE CONTENTS

COURSE STRUCTURE
Global Course Structure

Level	GNS/ GST	Basic Science	(GET)	UIL-EEE	Program (EEE)	SIWES & Eng. Valuation	Total Units
100	4	18	3		2		34
200	4	-	25		6	3*	35
300	4	-	18	5	10	4*	37
400		-	4	20	0	4*	24
500		-	5	20	6	-	31
Total	12	18	55	45	24	11*	154

* All 11 SIWES units and 2 units of Engineering valuation courses are credited for GPA computation in the 2nd Semester of the 400 Level, and not included in the CCMAS credit units.

100 Level Harmattan Semester

Course Code	Course Title	Units	Status	LH	PH
GST 111	Communication in English	2	C	15	45
GET 101	Engineer in Society	1	C	15	-
CHM 101	General Chemistry I	3	C	45	-
CHM 107	General Practical Chemistry I	1	C	-	45
MTH 101	Elementary Mathematics I	2	C	30	-
PHY 101	General Physics I	2	C	30	-
PHY 103	General Physics III	2	C	30	-
PHY 107	General Practical Physics I	1	C	-	45
	Total	14			

100 Level Rain Semester

Course Code	Course Title	Units	Status	LH	PH
GST 112	Nigerian Peoples and Culture	2	C	30	-
GET 102	Engineering Graphics and Solid Modelling I	2	C	30	-
CHM 102	General Chemistry II	3	C	45	-
CHM 108	General Practical Chemistry II	1	C	-	45
MTH 102	Elementary Mathematics II	2	C	30	-
PHY 108	General Practical Physics II	1	C	-	45
EEE 102	Introduction to Electrical and Electronic Engineering	2	C	30	-
	Total	13			

200 Level Harmattan Semester

Course Code	Course Title	Units	Status	LH	PH
ENT 211	Entrepreneurship and Innovation	2	C	30	-
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 and Software Engineering	3	C	30	45
*GET 299	SIWES I: Students Work Experience Scheme	3	C	9 Weeks	
	Total	22			

200 Level Rain Semester

Course Code	Course Title	Units	Status	LH	PH
GST 212	Philosophy, Logic and Human Existence	2	C	30	-
GET 204	Students Workshop Practice	2	C	15	45
GET 206	Fundamentals of Thermodynamics	3	C	45	-
GET 210	Engineering Mathematics II	3	C	45	-
EEE 202	Applied Electricity II	3	C	30	45
EEE 204	Electrical Engineering Materials	3	C	45	-
	Total	16			

300 Level Harmattan Semester

Course Code	Course Title	Units	Status	LH	PH
GET 301	Engineering Mathematics III	3	C	45	-
GET 305	Engineering Statistics and Data Analytics	3	C	45	-
GET 307	Introduction to Artificial Intelligence, Machine Learning and Convergent Technologies	3	C	45	-
EEE 311	Electric Circuit Theory I	2	C	30	-
EEE 321	Analogue Electronic Circuits I	2	C	30	-
UIL-EEE 331	Electrical Machines I	3	C	45	-
*GET 399	SIWES II: Students Work Experience Scheme	4	C	12 Weeks	
	Total	20			

300 Level Rain Semester

Course Code	Course Title	Units	Status	LH	PH
GST 312	Peace and Conflict Resolution	2	C	30	-
ENT 312	Venture Creation	2	C	15	45
GET 302	Engineering Mathematics IV	3	C	45	-
GET 304	Technical Writing & Communication	3	C	45	-
GET 306	Renewable Energy Systems and Technology	3	C	30	45-
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	C	30	-
UIL-EEE 344	Principles of Power System	2	C	30	-
	Total	22			

400 Level Harmattan Semester

Course Code	Course Title	Units	Status	LH	PH
ELE 405	Engineering System Modeling and Simulation	3	C	45	
UIL-EEE 421	Principles of Communication Engineering	2	C	30	-
UIL-EEE 423	Data Communications and Computer Networks	2	E	30	-
UIL-EEE 427	Digital Communication Systems	2	E	30	-
UIL-EEE 431	Electrical Machines II	3	E	45	-
UIL-EEE 443	Power Electronics and Drives	2	C	45	
UIL-EEE 445	Electrical Power Transmission Line Characteristics	2	E	30	-
UIL-EEE 451	Control Engineering I	2	C	30	-
UIL-EEE 455	Digital System Design and VHDL Programming	2	E	30	-
UIL-EEE 457	Assembly Language Programming	2	E	30	-
UIL-EEE 481	Electrical Engineering Laboratory Course III	1	C	-	45
*GET 499	SIWES III: Students Work Experience Scheme	4	C	12 Weeks	
	Total	27			

400 Level Rain Semester

Course Code	Course Title	Units	Status	LH	PH
GET 402	Engineering Project I	2	C		90
GET 404	Engineering Valuation and Costing	2	C	30	
	Total	4			

SIWES courses and Engineering valuation*

Course Code	Course Title	Units	Status	LH	PH
GET 299	SIWES I	3	C	9 weeks	
GET 399	SIWES II	4	C	12 weeks	
GET 499	SIWES III	4	C	12 weeks	
	Total	11*			

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

500 Level Harmattan Semester
Common courses

Course Code	Course Title	Units	Status	LH	PH
GET 501	Engineering Project Management	3	C	45	-
EEE 593	Final Year Project I	3	C		
	Total	6			

Power and Machines Option

Course Code	Course Title	Units	Status	LH	PH
UIL-EEE 541	Power Systems Communication and control	2	E	30	-
UIL-EEE 543	Electrical Power System Analysis	2	E	30	-
	Total	4			

Telecommunication and Electronics Option

Course Code	Course Title	Units	Status	LH	PH
UIL-EEE 521	Mobile and Personal Communication Systems	2	E	30	-
UIL-EEE 525	Digital Signal Processing	2	E	30	-
	Total	4			

Computer and Control Option

Course Code	Course Title	Units	Status	LH	PH
UIL-EEE 525	Digital Signal Processing	2	E	30	-
UIL-EEE 551	Control Engineering II	2	E	30	-
	Total	4			

500 Level Rain Semester
Common Courses

Course Code	Course Title	Units	Status	LH	PH
GET 502	Engineering Law	2	C	30	-
UIL-MEE 544	Industrial Engineering II	2	E	30	
EEE 594	Final Year Project II	3	C		
	Total	7			

Power and Machines Option

Course Code	Course Title	Units	Status	LH	PH
UIL-EEE 542	Power System Protection	2	E	30	-
	Total	4			

Telecommunication and Electronics Option

Course Code	Course Title	Units	Status	LH	PH
UIL-EEE 524	Broadcasting and Internet Technology	2	E	30	-
UIL-EEE 528	Satellite Communications	2	E	30	-
	Total	4			

Computer and Control Option

Course Code	Course Title	Units	Status	LH	PH
UIL-EEE 552	Digital Control Engineering	2	E	30	-
UIL-EEE 554	Nonlinear Control Systems	2	E	30	-
	Total	4			

300 Level Practical is to be added

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, curriculum vitae, report writing, note-making) etc. Mechanics of writing. Information and Communication Technology

in modern language learning. Language skills for effective communication. The art of public speaking.

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

Learning Outcomes

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

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

Course 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, 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, students should be able to:

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

Course 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 work spaces. Sketching of 3D objects. Viewports and sectioning to shop drawings in orthographic projections and perspectives. Automated viewports. Sheet metal and surface modelling. Material selection and rendering. This course will use latest professional design tools such as fusion 360, solid works, solid edge or equivalent.

CHM 101: General Chemistry I (3 Units C: LH 30)

Learning Outcomes

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

1. define atom, molecules and chemical reactions;
2. discuss the modern electronic theory of atoms;
3. write electronic configurations of elements on the periodic table;
4. rationalise the trends of atomic radii, ionisation energies, electronegativity of the
8. elements, based on their position in the periodic table;
5. identify and balance oxidation–reduction equation and solve redox titration
9. problems;
6. draw shapes of simple molecules and hybridised orbitals;
7. identify the characteristics of acids, bases and salts, and solve problems based on

10. their quantitative relationship;
8. apply the principles of equilibrium to aqueous systems using LeChatelier's
11. principle to predict the effect of concentration, pressure and temperature changes on equilibrium mixtures;
12. analyse and perform calculations with the thermodynamic functions, enthalpy,
13. entropy and free energy; and
14. 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 102: General Chemistry II (3 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 their applications;
3. discuss electronic theory;
4. determine the qualitative and quantitative of structures in organic chemistry;
5. describe rules guiding nomenclature and functional group classes of organic chemistry;
6. determine rate of reaction to predict mechanisms of reactions;
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.

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

Learning Outcomes

At the end of this course, 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, gravimetric analysis, data analysis and presentation.

CHM 108: General Chemistry Practical II (1 Unit C: PH 45)

Learning Outcomes

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

1. identify the general laboratory rules and safety procedures;
2. collect scientific data and correctly carrying out Chemical experiments;
3. identify the basic glassware and equipment in the laboratory;
4. identify and carry out preliminary tests which includes ignition, boiling point, melting point, test on known and unknown organic compounds;
5. perform solubility tests on known and unknown organic compounds;
6. conduct elemental tests on known and unknown compounds; and
7. conduct functional group/confirmatory test on known and unknown compounds which could be acidic / basic / neutral organic compounds.

Course Contents

Continuation of CHM 107. Additional laboratory experiments to include functional group analysis, quantitative analysis using volumetric methods.

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 the use of Venn diagrams;
1. solve quadratic equations;
2. solve trigonometric functions;
3. identify various types of numbers; and
4. 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
5. continuity;
6. identify the derivative as limit of rate of change;
7. identify techniques of differentiation and perform extreme curve sketching;
8. identify integration as an inverse of differentiation;
9. identify methods of integration and definite integrals; and
10. 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).

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 or rotating objects;
6. explain and apply the principles of conservation of energy, linear and angular momentum;
7. describe the laws governing motion under gravity; and
8. explain motion under gravity and quantitatively determine behaviour of objects moving under gravity.

Course Contents

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

PHY 103: General Physics III (Behaviour of Matter) (2 Units C: LH 30)

Learning Outcomes

On completion, the students should be able to:

1. explain the concepts of heat and temperature and relate the temperature scales;
2. define, derive and apply the fundamental thermodynamic relations to thermal systems;

3. describe and explain the first and second laws of thermodynamics, and the concept of entropy;
4. state the assumptions of the kinetic theory and apply techniques of describing macroscopic behaviour;
5. deduce the formalism of thermodynamics and apply it to simple systems in thermal equilibrium; and
6. describe and determine the effect of forces and deformation of materials and surfaces.

Course Contents

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

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

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 that have been covered with emphasis on quantitative measurements, the treatment of measurement errors, and graphical analysis. However, emphasis should be placed on the basic physical techniques for observation, measurements, data collection, analysis and deduction.

EEE 102: Introduction to Electrical and Electronic Engineering (2 units C: LH 15)

Learning Outcomes

Students will be able to:

1. comprehend the duties and functions of an Electrical and Electronic Engineer (EEE);
2. state the requirements for the profession and career opportunities;
3. state the careers related to EEE; and
4. 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). Passive components (R, L, C, transformers): descriptive features, including values and colour codes, uses in electrical circuits. DC and AC signal parameters

200 Level

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,
7. including business planning;
8. describe contemporary entrepreneurial issues in Nigeria, Africa and the rest of the
9. world; and
10. state the basic principles of e-commerce.

Course Contents

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

GST 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 and logic.

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

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

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

GET 204: Students Workshop Practice (2 Units C: LH 15; PH 45)
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
2. devices and instruments, and acquire skills in their effective use and maintenance;
3. 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;
4. master workshop and industrial safety practices, accident prevention and ergonomics;
5. physically recognise different electrical & electronic components like resistances, inductances, capacitances, diodes, transistors and their ratings;
6. connect electric circuits, understand different wiring schemes, and check ratings of common household electrical appliances and their basic maintenance; and
7. 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 pipe fittings (valves, orifices, bends and elbows) on fluid flow in pipes;
5. measure flow parameters with venturi meters, orifice meters, weirs and others;
6. perform calculations based on principles of mass, momentum and energy conservation;
7. perform dimensional analysis and simple fluid modelling problems; and
8. specify the type and capacity of pumps and turbines for engineering applications.

Course 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 substances such as compressed liquid, saturated liquid-vapour mixture and superheated vapour using property diagrams and tables;
5. arrange the ideal and real gas equations of state, formulate the first law of thermodynamics for a closed system i.e. organize the change in energy in the closed systems via heat and work transfer;
6. distinguish heat transfer by conduction, convection and radiation, and calculate the amount of heat energy transferred;
7. calculate the changes in moving boundary work, spring work, electrical work and shaft work in closed systems;
8. apply the first law of thermodynamics for closed systems and construct conservation of mass and energy equations;

9. formulate the first law of thermodynamics to the open systems i.e. describe steady-flow open system, apply the first law of thermodynamics to the nozzles, diffusers, turbines, compressors, throttling valves, mixing chambers, heat exchangers, pipe and duct flow;
10. construct energy and mass balance for unsteady-flow processes;
11. evaluate thermodynamic applications using second law of thermodynamics;
12. calculate thermal efficiency and coefficient of performance for heat engine, refrigerators and heat pumps; and
13. restate perpetual-motion machines, reversible and irreversible processes.

Course 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. First and second moments of area; centroids. Kinematics of particles and rigid bodies in plane motion. Newton's laws of motion. Kinetic energy and momentum analyse.

GET 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’s theorem;
5. explain ordinary differential equations and applications, and develop a mathematical model of linear differential equations, as well as appreciate the necessary and sufficient conditions for total differential equations; and
6. analyse basic engineering models through partial differential equations such as wave equation, heat conduction equation, etc., as well as fourier series, initial conditions and its applications to different engineering processes

Course Contents

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

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

Learning Outcomes

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

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

Course Contents

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

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

Learning Outcomes

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

1. describe and apply computing, software engineering knowledge, best practices, and standards appropriate for complex engineering software systems;
2. develop competence in designing, evaluating, and adapting software processes and software development tools to meet the needs of an advanced development project

through practical object-oriented programming exposure taught in concrete terms with a specific modern language – preferable selected from Python, Java or C++;
3. use widely available libraries to prepare them for machine learning, graphics and design simulations;
4. develop skills in eliciting user needs and designing an effective software solution;
5. recognise human, security, social, and entrepreneurial issues and responsibilities relevant to engineering software and the 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 long vacation following 200 level).

NOTE: Each programme to indicate additional details of programme-specific activities for their students.

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 C: LH 45)

Learning Outcomes

Students will be able to:

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

Course 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.

300 Level

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.

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

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 and its conflict resolution organs. (b) The African Union & Peace Security Council (c) ECOWAS in peace keeping). The media and traditional institutions in peace building. Managing post-conflict situations/crises: Refugees. Internally Displaced Persons (IDPs);the role of NGOs in post-conflict situations/crises.

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

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 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. Sturm-Liouville boundary value problems. Solutions of equations in two and three dimensions by separation of variables. Eigen value problems. Use of operations in the solution of partial differential equations and Linear integral equations. Integral transforms and their inverse including Fourier, Laplace, Mellin and Handel Transforms. Convolution integrals and Hilbert Transforms. Calculus of finite differences. Interpolation formulae. Finite difference equations. RungeKutta and other methods in the solutions of ODE and PDEs. Numerical integration and differentiation.

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

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 of correspondences – business report and proposal, business letter, memorandum, e-mails, etc. Proposals for projects and research; format, major steps and tips of grant-oriented proposals. Research reports(competency, major steps, components and formats of research reports and publishable communication). Sources and handling of data, tables, figures, equations and references in a report. Presentation skills; overview, tips, organisation, use of visual aids and practising of presentation. Intellectual property rights in research reports. Case studies of major engineering designs, proposals and industrial failures with professional presentation of reports.

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

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 and percentiles. Probability. Binomial, Poisson hyper-geometric and normal distributions. 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; trans-esterification of edible oil into biodiesel; simulation of geothermal energy; Geiger-Muller or Scintillation Counters' determination of uranium or thorium energy; simple solid or salt storage of energy; hybrid application of renewable energy.

GET 307: Introduction to Artificial Intelligence, Machine Learning and Convergent Technologies (3 Units C: LH 45)
Learning Outcomes

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

1. explain the meaning, purpose, scope, stages, applications and effects of artificial intelligence;
2. explain the fundamental concepts of machine learning, deep learning and convergent technologies;
3. demonstrate the difference between supervised, semi-supervised and unsupervised learning;

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

Course 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 (4 Units C: 12 weeks)

Learning Outcomes

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

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

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

Course Contents

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

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

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

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

Examples of projects should include the following:
a. Design of machine components;
b. Product design and innovation;
c. Part modelling and drafting in SolidWorks; and d. Technical report writing.

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

Learning Outcomes

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

Course 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 C: LH 30)

Learning Outcomes

Students will be able to:

1. classify, describe and discuss the various logic gates and flip-flops and multivibrators; and
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 C: LH 30)

Learning Outcomes

Students will be able to:

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

Course 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 C: LH 30)

Learning Outcomes

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

1. analyse on-linear circuits using approximation methods;
2. state the conditions for realisability of transfer functions;
3. design/synthesize RL, RC, LC and RLC circuits from given transfer functions; and
4. design passive and active filters from transfer functions and performance specifications.

Course 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.

UIL-EEE 331: Electrical Machines I (3 Units C; LH = 45)

Senate Approved Relevance

In an effort to produce graduates of electrical and electronics engineering that are globally competitive, electrical and electronics engineering students should be trained to be

knowledgeable in the area pertaining to electrical machines. This will go long way in realising the mission of the University of Ilorin.

Course Overview

Electrical machines convert mechanical energy into electrical energy or vice versa, and they are either rotating or static. The conversion takes place due to the presence of the magnetic field. The rotating electrical machines include the DC machines (generators and motors), while the transformer which converts alternating current from one voltage level to another voltage is an example of a static machine. The concept of the magnetic field is fundamental to the operation of electrical machines.

Depending on the starting torque required, DC machines are used in lathe machines, blowers, fans, elevators, steel mills, rolling mills, locomotives, and excavators. Transformers have various applications, such as in power systems where power and distribution transformers are employed for power transmission and distribution, while voltage and current transformers are used in metering systems. The course will expose the students to the principle of all electrical machines, specifically the transformer employed in the power systems and DC motor used in control system.

Objectives

The objectives of the course are to:

1. describe the electromechanical energy conversion systems;
2. describe the relationship between rotating and static electrical machines;
3. identify different electrical machines applicable in the industries;
4. describe the principle of the electrical DC machines;
5. explain the operational principles of transformers;
6. explain the voltage and current transformation ratios;
7. interpret the transformer's phasor diagram;
8. describe the short circuit and open circuit tests of transformer;
9. determine the regulation of transformer for the open and short circuit tests; and
10. describe the transformer cooling methods.

Learning Outcomes

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

1. describe the magnetic field, flux and magnetomotive force (MMF) in magnetic circuits;
2. explain the operating principles of four (4) fundamental components of electric machines, motors, generators and transformers;
3. explain four (4) poles DC machines, yoke, pole, windings, emf generation;
4. analyse three (3) voltage-current characteristics, commutation of DC generators, torque-speed characteristics and speed regulation of DC motors;
5. sketch and explain the principle of electromagnetic induction as applied to transformer operation, voltage ratio, transformation, parameters referred to primary and secondary;
6. describe the construction, working principles, characteristics and equivalent circuits of single and three-phase transformers;
7. explain the transformer phasor diagram (on load and on no load);
8. perform two (2) transformer tests, open and short circuit tests;
9. implement transformer analysis using four (4) standard testing procedures, including open-circuit and short-circuit tests, voltage regulation, efficiency and circuit analysis involving transformers; and
10. explain at least three (3) methods of cooling the transformer.

Course Contents

Prerequisite: EEE 202. Introduction to machinery principles. Rotational motion, Newton's law, magnetic circuit with air gap. Faraday's law. Production of induced force on wire. Induced voltage on a conductor moving in a magnetic field. The concept of energy conversion. DC machine fundamentals, simple rotating loop between curved pole faces, construction. Armature winding. Armature reaction. Commutation and methods of improving it. Internal generated voltage and induced torque equations of real machines. DC generators. Voltage regulation. Equivalent circuits. Working and characteristics of separately excited, shunt, series and compound generators. Parallel operations of direct current generators. DC motors, introduction, speed regulation, equivalent circuits, working and characteristics of permanent magnet. Separately excited, shunt, series and compounded motors. Torque equation. Operating characteristics of dc motors, efficiency calculations, Stepper motor and drive circuit. Transformer fundamentals, construction, principle of operation and types, Ideal transformer. Leakage reactance. Theory and operation of three-phase transformer. Losses and phasor diagram. Equivalent circuit of a real transformer. No-load and short-circuit tests. The transformer voltage regulation and efficiency. Autotransformers and the concept of its power rating advantages. Transformer cooling methods.

UIL-EEE 344: Principles of Power Systems (2 Units C; LH = 30)

Senate Approved Relevance

In an effort to produce graduates of electrical and electronics engineering that are globally competitive, electrical and electronics engineering students should be trained to be knowledgeable in the area pertaining to principles of power systems. This will go long way in realising the mission of the University of Ilorin.

Course Overview

The power system is a network consisting of generation, transmission and distribution systems. At the generating stations, the energy from the sun, wind, water, fuels and nuclear energy is converted into electrical energy through the prime mover coupled with the alternator. The bulk power produced is transported to the load centre through the transmission systems, which consist of components such as conductors, transformers and circuit breakers. The voltage is stepped down at the substations for onward distribution to the consumers who are the end users.

The course intends to expose the student to the complex nature of how electricity is generated and distributed for the nation's growth. Students are expected to visit some of the power plants around the country to understand and appreciate the complex arrangement which produces electricity consumed.

Objectives

The objectives of the course are to:

1. identify various sources of energy and their conversion to electrical energy;
2. describe different types of power generating stations;
3. identify power generating stations in Nigeria;
4. explain the structure of the electric power system from generating station to the consumers;
5. identify different types of consumers on power systems;
6. describe the load curve and its importance to power station units;
7. explain the concept of the economics of power generation;
8. explain the importance of the power factor and its implications on the power system;
9. identify equipment used for power factor correction; and
10. explain tariff and its objectives in the power system.

Learning Outcomes

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

1. explain the construction, working principles, characteristics and choice of three power
2. generating stations (hydro, thermal and Nuclear);
3. explain power generating stations based on the energy sources, coal, gas, water etc;
4. organise at least one visit to power generating stations; Jebba, Omotosho Egbin, Kanji etc.;
5. describe the traditional structure of power systems, generation, transmission system,
6. distribution system and their components;
5. identify four (4) consumers, residential, commercial and industrial ;
6. interpret and explain three (3) load curve methods of meeting the load;
7. analyse the economics of power station, cost of electrical energy and its expressions,
7. depreciation and two (2) methods of determination, load factor;
8. describe power factor, four (4) disadvantages of power factor, equipment used for
9. power factor improvement and the most economical power factor;
10. differentiate a synchronous condenser and static capacitor used in power factor correction; and
11. analyse tariff, characteristics of a tariff and describe at least four (4) types.

Course Contents

Prerequisite: UIL-EEE 202. Introduction to power systems. Sources of energy - Sun, wind, water, fuels, nuclear energy. Generating stations - steam power station (thermal station), choice of site, hydroelectric power station. Choice of site for hydroelectric power stations. Diesel power station. Nuclear power station. Schematic arrangement of nuclear power station, selection of site for nuclear power station. Comparison of the various structures of electric power system. Variable load on power station. Load curves. Types of loads, diversity factors, load curves and selection of generating units. Interconnected grid system. Economics of power generation. Cost of electrical energy, expressions for cost of electrical energy, methods of determining depreciation. Tariff - characteristics of a tariff, types of tariff. Power factor. Power triangle. Disadvantages of low power factor. Causes of low power factor. Power factor improvement. Calculations of power factor correction. Importance of power factor improvement and most economical power factor.

Minimum Academic Standards: As stated in the CCMAS

400 Level

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; LH 30)
Learning Outcomes
At the end of this course, the students should be able to:
1. Identify at least three (3) objectives of engineering valuation work, valuer's primary duty and responsibility and valuation terminologies.
2. Describe at least four (4) Valuer's obligation to his or her client, to other valuers, and to the society.
3. Demonstrate with example the engineering valuation methods, valuation standards, and practices.
4. Prepare engineering valuation and appraisal reports and review
5. Discuss expert witnessing and ethics in valuation.
6. Determine price, cost, value, depreciation and obsolescence in real property, personal property, personal property, machinery and equipment, oil, gas, mines, and quarries valuation.

GET 499: Students Industrial Work Experience III (4 Units C: 12 weeks)
Learning Outcomes
Students on Industrial Work Experience Scheme (SIWES) are expected to:
1. be exposed and prepared for the Industrial work situation they are likely to meet after graduation, by developing their occupational competencies;
2. bridge the existing gap between theory and practice of programmes through exposure to real-life situations, including machines and equipment handling, professional work methods and ethics, human relations, key performance assessment methods, and ways of safeguarding the work environment – human and materials;
3. experience/simulate the transition phase of students from school to the world of work and the environment seamlessly, and expose them to contacts for eventual job placements after graduation;
4. be motivated to identify the industrial and practice engineering challenges of their place of engagement and the larger society and creatively device impactful solutions to them; and
5. exploit the opportunity to improve and utilise their acquired critical thinking and innate creativity skills, during the program and SIWES Seminar presentation respectively.

Course Contents
On-the-job experience in industry chosen for practical working experience but not necessarily limited to the student’s major (24 weeks from the end of the first semester at 400-Level to the beginning of the first semester of the following session. Thus, the second semester at 400-Level is spent in industry). Each student is expected to work in a programme related industry, research institute or regulatory agencies etc, for a period of 6 months under the guidance of an appropriate personnel in the establishment but supervised by an academic staff of the Department. On completion of the training, the student submits the completed Log book on the experience at the establishment., Also, there will be a comprehensive report covering the whole of the student’s industrial training experiences (GET 299, GET 399 and GET 499), on which a seminar will be presented to the Department for overall assessment.

UIL-EEE 421: Principles of Communication Engineering (2 Units C; LH = 30)
Senate Approved Relevance
This course trains electrical and electronics engineering students to understand communication systems and the principles behind using modulation techniques to transmit signal over a long distance. Relevance is seen in the electrical and electronics engineering graduates' ability to anticipate signal transmission problems within any wireless communication industry while quickly analysing and determining the cause of underlying issues.

Course Overview
This course is expected to expose students to communications network and their constituents. The course exposes students to learn how to clarify the principle behind the conversion of information signals between digital and analog forms.
Students are expected to be grounded on how to modulate and demodulate a signal, characterize noise waveform and its effects on the communication system. They will be exposed to the theory of broadcasting, including radio and television broadcasting. The relationship between transmission power and frequency reuse factor are parts of what they will gain in this course.

Objectives
The objectives of the course are to:
1. discuss the different telecommunication networks and the function of their constituents:
2. explain signal modulation and the properties of communication links;
3. outline the principle behind the conversion of information signals between digital and analog forms;
4. explain the single sideband suppressed carrier modulation;
5. identify various methods of FM demodulation;
6. identify the drawbacks of direct methods for FM generation;
7. categorize the TV broadcast band and specification;
8. propose a suitable modulation method for different broadcast scenarios;
9. explain the engineering fundamentals of phase locked loop; and
10. explain the relationship between phase modulation and frequency modulation.

Learning Outcomes
At the end of this course, students should be able to:
1. explain communication system and describe at least three (3) types of transmission;
2. describe the concept of frequency spectrum;
3. analyse signals and vectors;
4. explain the purpose of modulation;
5. describe at least three (3) types of modulations techniques;
6. identify three (3) limitations of at least two (2) types of modulation techniques in their application;
7. describe two (2) effects of noise on AM and FM systems;
8. describe the evolution of TV systems using block diagrams;
9. classify the TV broadcast band and specification; and
10. prescribe the best modulation technique for at least two (2) broadcast scenarios.

Course Contents

Prerequisite: EEE 342. Brief historical development on communications. Types of transmission. Block diagram of a communication system. Signal spectrum, convolution, power and energy, correlation. Reasons for modulation. Types of modulation. AM system. AMDSB. AMDSBSC. AMSSB. AMVSB (modulation depth, power, frequency spectrum, generation, demodulation, application). Frequency mixing. Frequency modulation system. Frequency deviation. Modulation index. Significant sideband criteria. Bandwidth of a sinusoidally modulated FM signal. Power of an FM signal. Narrowband FM. Direct and indirect FM generation. Various methods of FM demodulation. Discriminator. Phase-locked loop. Limiter pre-emphasis and de-emphasis. Noise waveforms and characteristics. Effect of noise on AM and FM systems. Antenna principle and design. Block diagram of a superheterodyne AM radio receiver, broadcast band and specification. TV broadcast band and specifications. Transmitter and receiver block diagrams of black and white TV, and Color TV.

Minimum Academic Standards: As stated in the CCMAS

UIL-EEE 423: Data Communications and Computer Networks (2 Units E; LH = 30)

Senate Approved Relevance

In a bid to produce students who are employable globally in an ICT driven industrial landscape, students are required to be vast in all processes involved data communication techniques, and enabling technologies in computer networks that cut across different fields of human endeavour. Given that the on-going advancement in technology are powered by the 3rd wave of digital transformation brought about by the 4th/5th industrial revolution, it is important for students to be well grounded in the emerging and evolving digital transformation and be able to apply them to real life scenarios.

Course Overview

This course intends to train students in the mastery of data communication techniques and computer networks using industry best practices and standards. The course exposes students to the concepts of reliable data transmission and control for effective communication; protocols, standards and services that ensure data synchronization; and networking schemes that support bandwidth optimisation.

Applicable troubleshooting methodology learnt in the course of this module is a building block for skills acquisition requirement for the ICT industry and also a major pedagogic focus of this course. In addition, students are expected to be well grounded in various computer networking skills having mastered the art of configuring and troubleshooting typical networks using tools such as Packet tracer, Wireshark, Putty.

Objectives

The objectives of this course are to:

1. describe the processes involved in data communication;
2. describe protocols, standards and services in data communication;
3. describe techniques usable for effective transmission of data i.e., transmission codes, modes, and types;
4. explain the concept of error prevention, detection and correction in data communication;
5. explain data processing methods for batch, online, real time and distributed processing;
6. explain the concept and application of OSI abstract model;
7. compare and contrast the OSI model and the real internet suite in network architecture;
8. explain emerging web technologies for switch-centric and server-centric network topologies;

9. explain the underlying concept behind the vast and distributed network of Internet of Things Core (IoT-Core), Industrial Internet-of-Things (IoT) and Internet of Everything (IoE); and
10. design different types of computer network architectures using the different topologies, protocols and standards.

Learning Outcomes

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

1. distinguish between data communications and networking;
2. describe the concept of network topology;
3. define at least two (2) protocols and their elements in networking;
4. explain what standards are;
5. enumerate three (3) different categories of standards;
6. list five (5) functions of the different standard organizations;
7. describe the OSI model and its 7- layers architecture;
8. discuss the 5-layers TCP/IP protocol suite;
9. design three (3) types of computer network architectures; and
10. explain the Internet of Things and its areas of applications.

Course Contents

Prerequisite: EEE 322, EEE 342. Introduction to data communications. LAN topology. Access methods. Signalling methods. WAN systems. Introduction to network protocol. Seven layer ISO-OSI standard protocols and network architecture. Peer-to-peer, client-server networks and their requirements. Local Area Networks Distributed system, PBX and cable based LANs. Topology, Medium access control methods. High speed and bridged local area networks. Information network software. Features and benefits of major recovery mechanisms. Network operating systems. Internet protocol, IPv4, IPv6. Internet programming. Intranet System administration and security issues.

Minimum Academic Standards: As stated in the CCMAS

UIL-EEE 427: Digital Communication Systems (2 Units E; LH = 30)

Senate Approved Relevance

It is important to expose electrical and electronics engineering students to the fundamentals of digital communications. This is because, today, almost all aspects of our day to day activities require one form of communication or the other. The proliferation of smart devices including smart phones and tablets, etc. have even made the relevance of digital communications more pronounced. Although, analog communications has been around for some time, some associated shortcomings have necessitated today's widespread use of digital means of communication. Some of such shortcomings are its susceptibility to signal corruption by noise, lack of data security, as well as inefficient use of the communications frequency spectrum, just to mention but a few. Digital communications on the other hand is able to suppress noise, encrypt data, and is also able to use the frequency spectrum more efficiently, which makes it an important course that should be studied by electrical and electronics engineering students.

Course Overview

This course is expected to expose students to the various categories of digital modulation techniques and their advantages over the analogue counterpart. Students will understand the concept of intersymbol interference (ISI), what causes it, and how it affects the accurate detection of digital signals. The course will also expose the students to how ISI can be reduced in digital communication systems.

In this course, the students will learn how to use graphical means, such as constellation and eye diagrams, to understand, identify, and debug digital communication systems. The course will also expose them to the principle, merits, and demerits of different spread spectrum techniques used in digital communications.

Objectives

The objectives of the course are to:

1. explain the basic types of digital modulation techniques;
2. explain how to determine Nyquist sampling rate for a signal and the necessity for sampling at or above that rate;
3. explain the significance of and the various line coding techniques;
4. explain the causes and effects of ISI;
5. explain constellation and eye diagrams and their application in digital communication systems;
6. explain the concept of equilisation with a block diagram and describe its application in ISI reduction;
7. explain different types of equalisers;
8. describe the mode of operation of FH spread spectrum;
9. describe the mode of operation of DS spread spectrum; and
10. describe the features CDMA.

Learning Outcomes

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

1. describe four (4) digital modulation techniques;
2. compute the Nyquist sampling rate for a given signal;
3. describe three (3) line coding methods;
4. explain two (2) causes and 2 effects of inter-symbol interference;
5. describe three (3) uses of eye pattern;
6. illustrate adaptive equalisation with a block diagram;
7. describe two (2) types of equalisers;
8. describe five (5) features of FH spread spectrum;
9. describe five (5) features of DS spread spectrum;3 and
10. describe four (4) advantages of CDMA over FDMA and TDMA.

Course Contents

Sampling and Nyquist rate. Pulse modulation methods. Digital modulation techniques. Amplitude Shift Keying (ASK). Frequency Shift Keying (FSK). Phase Shift Keying (PSK) Differential Phase Shift Keying (DPSK). Quadrature Phase Shift Keying (QPSK). M-ary modulation. Continuous phase FSK (CPFSK). Minimum Shift Keying (MSK). Quadrature Amplitude Modulation (QAM). Digital Subscriber Line (DSL) Schemes. Line coding. Inter-symbol interference (ISI). Nyquist wave-shaping. Eye pattern. Adaptive equalisation. Transmission over bandpass channel. Spread spectrum communications. Pseudo noise sequences. Direct sequence spread spectrum. Frequency hopping spread spectrum. Code division multiple access (CDMA). Application examples.

Minimum Academic Standards: As stated in the CCMAS

UIL-EEE 431: Electrical Machines II (3 Units E; LH = 45)

Senate Approved Relevance

In an effort to produce graduates of electrical and electronics engineering that are globally competitive, electrical and electronics engineering students should be trained to be

knowledgeable in the area pertaining to electrical machines. This will go long way in realising the mission of the University of Ilorin.

Course Overview

Induction machines are the most frequently encountered machine in homes and industries. They are cheap, rugged, simple and easy to maintain. They run at essentially constant speed from zero to full load, and their speed depends on the power supply frequency. The production torque is obtained via electromagnetic induction from the rotating magnetic field of the stator winding. Three-phase induction motors are self-starting and commonly used in industrial processes to operate other devices connected to them via belt, gear and rope.

A synchronous machine is an ac rotating machines whose speed is proportional to the frequency of the current in its armature under steady-state conditions. Its operation depends on the interaction between the magnetic field created from two sources: the stator current and the field current, both rotating at synchronous speeds and consequently resulting in a steady torque. Thus, these machines are called synchronous machines because they operate at constant speeds and frequencies under steady-state conditions.

Objectives

The objectives of the course are to:

1. describe the concept of rotating magnetic fields;
2. describe the principle of operation of polyphase induction motors;
3. categorise three (3) induction machines and explain four (4) applications;
4. describe the circuit diagram of an induction motor;
5. describe the rating and enclosures of three (3) phase induction motor;
6. describe the starting, speed control and braking of polyphase induction motor;
7. describe the principle of operation of synchronous machines;
8. explain the short-circuit and open-circuit tests for voltage regulation;
9. describe the production of sinusoidal alternating EMF;
10. describe the two-reactance concept for salient synchronous machines;
11. explain the parallel operation of alternators; and
12. describe the V-curves of a synchronous motor; and
13. explain the synchronous condenser.

Learning Outcomes

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

1. distinguish between analytical and graphical production of a three-phase rotating magnetic field;
2. examine the construction, operation, characteristics and equivalent circuit of three phase induction motors;
3. explain the working principles of single-phase induction motor, three phase induction motor, and special purpose motors;
4. examine four (4) various enclosures used in electrical machines;
5. explain the starting, speed control and braking of polyphase induction motors;
6. explain the construction, working principles, characteristics and equivalent circuit of three-phase synchronous generators and synchronous motors;
7. identify single and polyphase windings, concentric and distributed windings, single layer and double layer windings;
8. describe the EMF equation for concentric and distributed windings;

9. explain armature reaction, leakage reactance, synchronous reactance, short-circuit and open-circuit tests, construction of two-reaction diagram from short-circuit and open-circuit tests;
10. describe three (3) requirements for parallel operation, synchronising current, power and torque, parallel operation of alternators through transmission lines;
11. analyse the two-reactance concept for salient pole synchronous motors;
12. analyse the V-curve; and
13. identify the synchronous condenser and differentiate it from a synchronous motor.

Course Contents
Prerequisite: EEE 331. Three-phase Induction Motor - Construction, basic concepts and working principles. Synchronous speed, slip and its effect on rotor frequency and rotor voltage. Equivalent circuit, power and torque. Torque-speed characteristics. Losses, efficiency and power factor. Circuit diagram. Starting, speed control and braking of polyphase induction motor. Single-phase induction motor, introduction. Principles of operation, double-revolving field and cross-field theories. Starting single phase induction motors. Performance characteristics of split phase windings, capacitor start motor, permanent split capacitor motor, capacitor start and capacitor run motors. Universal motor, construction, operation, torque-speed characteristic and applications. Special purpose motors, shaded pole motors, reluctance motors, the hysteresis motor. AC Machines and fundamentals, a simple loop in a uniform magnetic field, induced voltage and induced torque. Synchronous generator, construction, excitation system. Equivalent circuit of synchronous generator, Phasor diagram. Short-circuit and open-circuit tests. Voltage regulation. Two-reactance concept for salient pole synchronous machines. Measurement of model parameters, construction of two-reaction diagram. Power development in synchronous generator. Effect of load changes on a generator. Parallel operation of generators. Synchronous Motor, basic principle of motor operation. Equivalent circuit. Torque-speed characteristics, power and torque equations. Phasor diagram, the effects of load change, and field current change. V-curves of a synchronous motor and power factor correction. Starting of synchronous motor. Synchronous motor ratings.

Minimum Academic Standards: As stated in the CCMAS

UIL-EEE 443: Power Electronics and Drives (2 Units C; LH = 30)
Senate Approved Relevance
In an effort to produce graduates of electrical and electronics engineering that are globally competitive, electrical and electronics engineering students should be trained to be knowledgeable in the area pertaining to power electronics. This will go long way in realising the mission of the University of Ilorin.

Course Overview
Power electronics is the study of electronic circuits for the control and conversion of electrical energy. It is the application of thyristors, a solid-state power semiconductor device, to control and convert electric power. Thus, it combines electric power, electronics and control systems.
An electrical drive is an electromechanical device for converting electrical energy into mechanical energy to impart motion to different machines and mechanisms for various control processes. Electric drives include the power modulator, motor, controlling and sensing units. This course aims to establish fundamental engineering knowledge relating to industrial drive and control process. In addition, it will expose students to the relevance of semiconductor devices in control applications such as light control, motor speed control used in industries, high voltage power supplies, high voltage direct current (HVDC) transmission.

Objectives

The objectives of the course are to:
1. describe the characteristics of electronic device;
2. explain power converters and their application;
3. explain AC to DC conversion;
4. describe a thyristor and its applications;
5. describe the principle of the electric drive system;
6. describe the speed control of the electric motor;
7. describe the solid-state control of DC motors;
8. explain the application of DC motor speed control in industrial drives;
9. explain electric braking concept in DC motor; and
10. describe the dynamic performance and mechanics of motor-load systems.

Learning Outcomes

At the end of the course, students should be able to:
1. describe four (4) power electronics components and their characteristics;
2. explain the basic operation, losses and efficiency of the power electronics converters;
3. describe power electronics circuit design and their applications;
4. explain four (4) switching circuits for industrial motor speed control;
5. describe at least four (4) limitations of practical converters in industrial applications;
6. explain three (3) factors governing the selection of electric motors; electrical characteristic, mechanical consideration, type of drive, service capacity and rating;
7. explain Ward-Leonard method of speed control;
8. describe constant torque and constant power drives;
9. explain electric braking, list three (3) advantages over mechanical braking, four (4) types of braking systems; and
10. analyse the industrial motor control drives in domestic, machine tools, milling and grinding machines, etc.

Course Contents

Prerequisite: EEE 321, EEE 331. Characteristics of power electronic devices. Device switching characteristics. Power losses and thermal design. Classes of power converters and their operations. Rectifiers. AC-AC converters. DC-DC converters. Inverters. Voltage and current source converters. Voltage and current regulation. Regulator circuits. The thyristor or SCR and its applications, timing circuits, switching and resonant circuits. Power supplies (uninterruptible, switch mode). Advanced energy efficient motor drives. Power electronic control principles. Vector and servo drives (stepper, DC, induction, brushless PM and switched-reluctance). Modulation methods. Drive components and principles. Types of drive systems - individual, group and collective drives. Thermal rating, duty cycle, heating and cooling time constant of motors. Dynamic performance and mechanics of motor-load systems, load fluctuation and load equalisation. Speed control and speed-time relation of motors. Electric braking. Selection of motors (electrical and mechanical characteristics). Speed control of DC and AC motors using thyristors, frequency converters and their application in AC and DC motor control using feedback control loops, loop transfer function.

Minimum Academic Standards: As stated in the CCMAS

UIL-EEE 445: Electrical Power Transmission Line Characteristics (2 Units E; LH = 30)

Senate Approved Relevance

In an effort to produce graduates of electrical and electronics engineering that are globally competitive, electrical and electronics engineering students should be trained to be knowledgeable in the area pertaining to electrical power transmission line characteristics. This will go long way in realising the mission of the University of Ilorin.

Course Overview

Electrical power transmission involves the movement of bulk electrical energy from the power generating stations or power plants to an electrical substation, where voltage is transformed and distributed to other substations or consumers. The transmission system refers to the network that transmits and delivers power, which could be overhead or underground. The transmission system is divided into primary and secondary depending on the voltage ratings. Typically, in Nigeria, the primary transmission line voltage is 330 kV, while the secondary is 132 kV.
Due to the network component, the evaluation of different parameters that affect the performance of the transmission line for effective power delivery is required. These parameters include resistance, inductance and capacitance.

Objectives

The objectives of the course are to:
1. identify various conductors used in overhead transmission lines;
2. describe different types of line supports and insulators in the power system;
3. describe sag in transmission lines;
4. identify different types of transmission line;
5. explain the inductance and capacitance concept in transmission line;
6. describe the performance of transmission line constants;
7. explain the ABCD parameters of a transmission line;
8. describe methods of laying underground cable;
9. identify thermal characteristics of underground cable;
10. identify insulating materials for cables; and
11. describe per unit system.

Learning Outcomes

At the end of the course, students should be able to:
1. explain three (3) conductors used in transmission, characteristics and choice conductor;
2. describe the mechanical design of overhead lines supports used in transmission and distribution systems: wooden, reinforced cement concrete poles, towers;
3. describe three (3) reasons for sag, effects on transmission line;
4. describe the short, medium and long transmission lines;
5. describe the electrical design of overhead lines, resistance, inductance and capacitance of three-phase overhead line;
6. describe the classification of overhead transmission lines, single-phase and three-phase short, medium and long transmission lines;
7. explain the generalised circuit constants of a transmission line ABCD parameters;
8. describe underground cable, construction and classification;
9. describe three (3) methods of laying underground cable;
10. list four (4) insulating material used in the protection of underground cables; and
11. describe the per unit system and state three (3) of its advantages in power system calculation.

Course Contents

Prerequisite: UIL-EEE 344. Overhead transmission lines, introduction, types. Elements of transmission line. Choice of conductor size. Choice of transmission voltage. Mechanical design of overhead lines, conductor materials, insulators. Corona. Sag. Electrical design of overhead lines, constant parameters. Calculation of inductances of single-phase and three-phase lines. GMR and GMD concept. Bundled conductors. Calculation of capacitance of single-phase and three-phase lines, current and voltage relations. Short, medium and long transmission lines derivation and calculations. Performance of transmission line constants, voltage and current relations. Generalised ABCD parameters and their determination. Underground cables, construction. Comparison with overhead lines. Insulation resistance, stress in insulation and capacitance. Capacitance grading. Thermal characteristics of cables. Per-unit system

Minimum Academic Standards: As stated in the CCMAS

UIL-EEE 451: Control Engineering I (2 Units C; LH = 30)
Senate Approved Relevance
In an effort to produce graduates of electrical and electronics engineering that are globally competitive, electrical and electronics engineering students should be trained to be knowledgeable in the area pertaining to control engineering. This will go long way in realising the mission of the University of Ilorin.

Course Overview
This course exposes students to the development of mathematical models of physical systems. Students will be able to analyse the response of the closed and open loop systems as well as analyse the stability of the closed and open loop systems. In addition, students will be able to design the various kinds of compensator and explain alternative representations of dynamic systems (time domain, frequency domain, state space).
This course exposes students to knowledge on how to analyze, design, and optimize simple systems which consist of highly integrated coordination of mechanical, electrical, chemical, metallurgical, electronic or pneumatic elements. Thus, control engineering deals with diverse range of dynamic systems which include human and technological interfacing. The control system engineering course focuses on analysis and design of systems to improve the speed of response, accuracy and stability of system. Students will know about the two methods of control system including classical methods and modern methods. The mathematical model of system is set up as first step followed by analysis, designing and testing.

Objectives
The objectives of the course are to:
1. discuss the mathematical modelling of some physical systems;
2. explain the response of the closed and open- loop systems;
3. analyse the stability of the closed and open-loop systems;
4. explain how to design various kinds of compensator;
5. explain alternative representations of dynamic systems (time domain, frequency domain, state space);
6. explain how to draw Bode plot;
7. explain how to determine stability of linear systems using the Routh array;
8. explain feedback and feed-forward control architecture and discuss the importance of performance, robustness and stability in control design;
9. interpret block diagram representations of control systems; and
10. discuss how to design PID controllers based on empirical tuning rule.

Learning Outcomes

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

1. develop the mathematical model of the physical systems;
2. analyse the response of the closed and open-loop systems;
3. analyse the stability of the closed and open-loop systems;
4. design two (2) lead and lag compensators;
5. explain three (3) alternative representations of dynamic systems (time domain, frequency domain, state space);
6. explain feedback and feed-forward control architecture and discuss the importance of performance, robustness and stability in control design;
7. interpret block diagram representations of electrical control systems and design PID controllers based on empirical tuning rules;
8. compute stability of linear systems using the Routh array test and use this to generate control design constraints;
9. employ Evans root locus techniques in control design for real world systems;
10. compute gain and phase margins from Bode diagrams and Nyquist plots and their effect on system stability and robustness;
11. design lead-lag compensators based on frequency data for an open-loop linear system;
12. analyse the stability of systems by root locus and frequency response methods;
13. develop the mathematical model of the physical systems;
14. draw two (2) Bode diagrams, three (3) root locus graphs and Nyquist plots for the analysis of control systems to solve numerical problems on control systems; and
15. utilise MATLAB/Simulink to analyse open and closed loop performance and design linear feedback controllers.

Course Contents

Prerequisite: EEE 311, EEE 312. Introduction to control systems - Concept of feedback and automatic control. Definition of linear and nonlinear systems. Elementary concepts of sensitivity and robustness. Types of control systems. Servomechanisms and regulators as examples of feedback control systems. Mathematical modelling of dynamic systems. Translational, rotational liquid level. Electrical analogy of spring-mass dashpot systems. Transfer function properties. Poles and zeros. Time-domain analysis of first- and second-order systems. Damped and undamped natural frequencies. Stability criteria - Routh-Hurwitz, Bode, root-locus, Nichol's chart. Signal flow graphs and Mason's rule. Control system components - potentiometers, synchros, resolvers, position encoders. AC and DC tachogenerators. Actuators. Control system performance measures. Control system improvement using compensators (lead, lag, lead-lag, PI, PD and PID).

Minimum Academic Standards: As stated in the CCMAS

UIL-EEE 455: Digital System Design and VHDL Programming (2 Units E; LH = 30)
Senate Approved Relevance

In an effort to produce graduates of electrical and electronics engineering that are globally competitive, electrical and electronics engineering students should be trained to be knowledgeable in the area pertaining to digital system design and VHDL programming. This will go long way in realising the mission of the University of Ilorin.

Course Overview

This course exposes students to the difference between microprocessor-based software programming language and programmable logic configuration using hardware description

language. Students will be able to use the VHDL as a programming language in the development of complex digital systems.
This course also exposes students to the knowledge of different types of programmable logic device that are available today, their differing architectures, and their use within electronic system design. It provides background into the area of electronic systems design, the types of solutions that may be developed, and the decisions that will need to be made in order to identify the right technology choice for the design implementation.

Objectives
The objectives of the course are to:
1. explain the difference between microprocessor-based software programming language and programmable logic configuration using hardware description language;
2. explain VHDL as a programming language;
3. explain the design of combinational and sequential logic circuits using VHDL;
4. design programmable logic devices (PLDs) and networks of arithmetic operations;
5. explain the VHDL software package and how to utilise the software to solve problems on a wide range of digital logic circuits;
6. explain different types of memory;
7. explain types of Programmable Logic;
8. explain programming logic device configuration techniques;
9. explain typical PLD design flow; and
10. explain sequential product development process.

Learning Outcomes
At the end of this course, students should be able to:
1. differentiate between microprocessor-based software programming language and programmable logic configuration using hardware description language;
2. explain VHDL as a programming language;
3. discuss programming logic device configuration techniques;
4. explain typical PLD design flow;
5. design three (3) combinational and 4 sequential logic circuits using VHDL;
6. design two (2) programmable logic devices (PLDs) and networks of arithmetic operations;
7. demonstrate proficiency with VHDL software package;
8. utilise software package to solve four (4) problems on a wide range of digital logic circuits;
9. discuss sequential product development process;
10. design three (3) digital logic circuits such as counters and divide circuit using sequential systems; and
11. discuss two (2) different types of memory to store, access provision, and modification of data and programme code within processor based electronic circuit.

Course Contents
Prerequisite: EEE 322. Finite state machine – definition. Mealy and Moore models. State diagram, state table, transition table. Sequential circuits design using flip-flops, asynchronous and synchronous circuit design. Algorithm state machine - design examples and exercises. Structured design. Design constructs. Design levels. Geometry-based interchange formats. Computer-aided electronic system design tools. Schematic circuit capture. Hardware description languages. Design process (simulation, synthesis). Structural design decomposition. Programmable logic devices (PLDs) types and configurations. Introduction to VHDL - VHDL language abstractions, design hierarchies, VHDL component, lexical description, VHDL source file, data types, data objects, language statements, concurrent VHDL, sequential VHDL, advanced features of VHDL

(library, package and sub-programmes). Structural level modeling. Register-transfer level modelling, FSM with data path level modelling, algorithmic level modelling. Introduction of ASIC - types of ASIC, ASIC design process, standard cell ASIC synthesis. FPGA design paradigm. FPGA synthesis. FPGA/CPLD architectures. VHDL Design - top-down design flow, verification, simulation alternatives, simulation speed, formal verification, recommendations for verification, writing RTL VHDL code for synthesis, top-down design with FPGA. VHDL synthesis, optimisation and mapping, constraints, technology library, delay calculation, synthesis tool, synthesis directives. Computer-aided design of logic circuits.
Minimum Academic Standards: As stated in the CCMAS

UIL-EEE 457: Assembly Language Programming (2 Units E; LH = 30)
Senate Approved Relevance
In an effort to produce graduates of electrical and electronics engineering that are globally competitive, electrical and electronics engineering students should be trained to be knowledgeable in the area pertaining to assembly language programming. This will go long way in realising the mission of the University of Ilorin.

Course Overview
This course exposes students to the basic assembly language syntax and the different 8086 microprocessor addressing modes. The students will be exposed to the memory subsystem as well as the input and output subsystems of the microcomputer. Also, this course exposes them to the various assembler directives.
This course also exposes students to the main internal hardware of a PC, consisting of processor, memory, and registers. Knowledge of how registers are processor components that hold data and address are inclusive. It introduces students to the basics of computer architecture, the relationship between C and assembly language and IA-32 assembly language, through an example.

Objectives
The objectives of the course are to:
1. explain basic assembly language syntax;
2. explain the underlying principle in machine-level data representations, computing, and programming;
3. discuss assembly programming for the x86 architecture, including register operations, control structures, bitwise operations, and subprograms;
4. discuss tasks like compiling, linking, loading, and debugging;
5. explain how to build program on a microprocessor using arithmetic and logical instruction set of 8086;
6. discuss the use of different 8086 addressing modes;
7. explain how to create and use a stack to store data, addresses, or both;
8. discuss the uses of the different 8086 instruction groups;
9. explain the general programming skills; and
10. be able to run assembly language code.

Learning Outcomes
At the end of the course, students should be able to:
1. use basic assembly language syntax;
2. describe the underlying principle in machine-level data representations, computing, and programming;
3. demonstrate proficiency in assembly programming for the x86 architecture, including register operations, control structures, bitwise operations, and subprograms;

4. perform four (4) operations including compiling, linking, loading, and debugging;
5. execute four (4) programs on a microprocessor using arithmetic and logical instruction set of 8086;
6. use ten (10) different 8086 addressing modes;
7. use a stack to store data, addresses, or both;
8. describe five (5) uses of the different 8086 instruction groups;
9. write an assembly language program; and
10. execute an assembly language program.

Course Contents

Prerequisite: GET 211. Introduction: Language level of abstraction and effect on machine, characteristics of machine code, advantages, justifications of machine code programming, instruction set and dependency on underlying processor. Intel 8086 microprocessor assembly language programming: programming model as resources available to programmer, addressing modes, instruction format, instruction set- arithmetic, logical, string, branching, programme control, machine control, and input/output, etc. Assembler directives, hand assembling, additional 80x86/Pentium instructions. Modular programming. Interrupt and service routine. Interfacing of assembly language to C. Intel 80x87 floating point programming. Introduction to MMX and SSE programming. Motorola 680x0 assembly language programming. Extensive practical engineering problems solving in assembly language using MASM for Intel. Cross-assembler for Motorola.
Minimum Academic Standards: As stated in the CCMAS

UIL-EEE 481: Electrical Engineering Laboratory Course III (1 Unit C; P = 45)
Senate Approved Relevance

Electrical engineering students need technical competence in the use of laboratory equipment. This is because most of the sophisticated technologies of today began as prototypes in the laboratory. It is therefore critical to expose electrical engineering students to extensive laboratory practicals that provide them with hands-on experience using electrical equipment such as function generators, digital multimeters, oscilloscopes, logic analyzers, power supplies, and specialised computer-aided design software packages. This will go a long way towards realizing the vision of the University of Ilorin in becoming an international centre of excellence in learning and research.

Course Overview

This course introduces students to the basic concepts of analogue communication with a focus on signal modulation and demodulation. It also exposes students to digital systems design components such as SR, JK, D, and T flip-flops.
In addition, students gain experience working with register operations such as parallel-in-parallel-out, serial-in-serial-out, parallel-in-serial-out, and serial-in-parallel-out operations. Furthermore, students will be exposed to the programming of the serial and parallel ports of the microcomputer to control attached peripherals such as light-emitting diodes and electric motors.

Objectives

The objectives of the course are to:
1. demonstrate amplitude modulation of a high-frequency carrier wave by a low-frequency modulating signal;
2. demonstrate amplitude demodulation using a demodulator;
3. demonstrate renewable energy generation;

4. demonstrate the mode of operation of the SR flip-flop;
5. demonstrate the mode of operation of the JK flip-flop;
6. demonstrate the mode of operation of the D flip-flop;
7. demonstrate the mode of operation of the T flip-flop;
8. demonstrate the mode of operation of shift registers;
9. demonstrate the mode of operation of counters;
10. demonstrate the control emitting diodes by a computer program;
11. demonstrate the control of the speed of rotation of a dc motor by a computer program; and
12. demonstrate the control of the direction of rotation of a stepper motor by a computer program;

Learning Outcomes
At the end of this course, the students should be able to:
1. draw four (4) graphs of the modulated signal that corresponds to 4 different modulation coefficients;
2. draw four (4) graphs, each representing four (4) different signals viewed at the detector inputs and outputs which correspond to four (4) different frequencies of the modulating signal;
3. determine four (4) power outputs of a solar panel for four (4) different light intensities and four (4) different distances between a solar panel and its light source;
4. measure four (4) corresponding output voltages of the SR flip-flop for four (4) different input combinations;
5. measure four (4) corresponding output voltages of the JK flip-flop for four (4) different input combinations;
6. measure four (4) corresponding output voltages of the D flip-flop for four (4) different input combinations;
7. measure four (4) corresponding output voltages of the T flip-flop for four (4) different input combinations;
8. determine the four (4) corresponding binary output patterns for four (4) binary input patterns fed into the shift register;
9. determine the maximum number of counts realizable by a 4-bit counter;
10. write a program that sends 8 bits of data to the computer port for controlling the on/off status of 8 light emitting diodes;
11. write a program that sends 8 bits of data to a computer port address for controlling the speed of rotation of a dc motor that is attached to that port; and
12. write a program that sends 8 bits of data to a computer port address for controlling the speed and direction of rotation of a stepper motor that is attached to that port.

Course Contents
Modulation experiments. Modulation coefficient. Bandwidth. Overmodulation. Demodulation experiments. Solar energy experiments. D flip-flop experiment. JK flip-flop experiment. Shift registers experiment. Parallel-in-parallel-out experiment. Serial-in-serial-out experiment. Parallel-in-serial-out experiment. Serial-in-parallel-out experiment. Counter experiment. Experiment on the control of light emitting diode by a computer program. Experiment to control dc motor speed with a computer program. Experiment to control a stepper motor with a computer program.

Minimum Academic Standards: As stated in the CCMAS

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), risk analysis, role of subject matter experts (SMEs), role conflicts; Gantt Chart, CPM and PERT. Optimisation, linear programming as an aid to decision making, transport and materials handling. Monitoring and Evaluation – key performance indices (KPIs); methods of economic and technical evaluation. Industrial psychology, ergonomics/human factors and environmental impact considerations in engineering project design and management. Project business case-financial, technical and sustainability considerations. Case studies, site visits and invited industry professional seminars. General principles of management and appraisal techniques. Breakthrough and control management theory; production and maintenance management. Training and manpower development. The manager and policy formulation, objective setting, planning, organising and controlling, motivation and appraisal of results.

GET 502: Engineering Law (2 Units C: LH 30)
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 of torts: definition, classification and liabilities. Patents: requirements, application, and infringement. Registered designs: application, requirements, types and infringement. Company law. Labour law and Industrial Law. Business registration.

EEE 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 written report of a developed system, and/or product/service and oral presentation/defense before a panel of assessors one of whom must be external to the University awarding the electronic engineering degree.

UIL-EEE 521: Mobile and Personal Communication Systems (2 Units E; LH = 30)
Senate Approved Relevance
In a bid to produce students who are employable globally in the mobile and personal communication industries, the students will be taught to have a comprehensive knowledge of most technical aspects, operations, and applications of current and future generations of cellular mobile and personal communication technologies. Students will be able to describe the emerging personal communications systems and emerging personal communications services. Focus will be on the cellular mobile radio while limited coverage on wireless LAN, wireless PAN, and fixed wireless will also be given. Design of wireless systems to counteract the channel and radio impairments will be an area to prepare the students. Trending topics in wireless communications will be introduced so as to make the students current and relevant in the industry.

Course Overview
This course intends to provide the students with a comprehensive knowledge of most technical aspects, operations, and applications of past, current and future generations of cellular mobile and personal communication technology. Students will be taken through the emerging personal communication systems and emerging personal communications services. The technology and underlying principles of wireless communications, building blocks of wireless networks, elementary examination of the science and technology of wireless communications including radio channel modeling, interference-limited communications, essential functions of all cellular telephone systems like frequency re-use, handover techniques and channel assignment strategies will be treated.
Review of the various standards and systems, which have been developed including 1G, 2G, 3G, 4G, 5G systems and basic issues involved in the design of wireless systems would be covered. Discussion of the potential problems associated with the access technology for the second/third/fourth/fifth-generation systems and providing the vision of the future-generation systems.

Objectives

The objectives of this course are to:

1. explain the history of mobile radio communications;
2. identify at least five examples of mobile radio communications;
3. explain the basic elements of cellular mobile systems;
4. explain the operation of cellular mobile systems;
5. design a cellular system using frequency reuse concept;
6. outline the different standards in analogue and digital cellular systems;
7. describe the different features of all the generations of cellular systems;
8. carry out analysis of the fifth-generation cellular systems;
9. apply channel assignment strategies for a wireless system using the different wireless standards, services and applications; and
10. To evaluate and optimise mobile cellular networks.

Learning Outcomes

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

1. recall the history of mobile radio communications;
2. list four (4) examples of mobile radio communications;
3. explain five (5) basic elements of cellular mobile systems;
4. describe two (2) operations of cellular mobile systems;
5. design a cellular system using frequency reuse concept;
6. differentiate between standards in analogue and digital cellular systems;
7. differentiate features of different generations of cellular systems;
8. analyse three (3) techniques used in fifth generation systems;
9. design for a wireless system (channel assignment strategies) using at least five (5) different wireless standards, services and applications; and
10. evaluate and optimise two (2) mobile cellular networks.

Course Contents

Prerequisite: UIL-EEE 423. Evolution (1G to 5G) and examples of mobile radio communications. Basic cellular system. Frequency reuse. Co-channel interference. Hand-off strategies. Traffic and grade of service. System capacity and improvement. Propagation path losses. Multipath propagation problem. Raleigh fading and Rician distribution. Doppler effects. Field strength prediction models. Standards and overview of digital cellular systems. GSM, EDGE, CDMA, WCDMA, LTE, and LTE-advanced. Frequency management and channel assignment. GSM architecture, elements, and standard interfaces. Fifth generation wireless standards. Paging and SMS services and technologies. Call Processing. Signalling. Roaming and mobility management. Route optimization.

Minimum Academic Standards: As stated in the CCMAS

UIL-EEE 524: Broadcasting and Internet Technology (2 Units E; LH = 30)

Senate Approved Relevance

In a bid to produce students with history of broadcasting and also have up to date knowledge in analogue digital broadcasting and how the internet is used to modernise broadcasting, the students will be trained in digital media, television and Internet technologies. The students will be taken through basic information on the principles and practices of digital television broadcasting in a systematic and structured manner. At the conclusion of the course, students will be prepared to work in any broadcasting industry because they will have correct information on understanding the engineering principles of digital television broadcasting and operational concepts of network extension, as well as new trends in the field of digital broadcasting and Internet Technology.

Course Overview

The course intends to provide the students with comprehensive understanding of basic broadcasting elements. Students will have valid information on understanding the engineering principles of digital television broadcasting and operational concepts of network extension. They will be able to identify new terms in the field of analog and digital television broadcasting.
Students will have knowledge of Internet broadcasting techniques, jamming and how TV channels work. Experience and knowledge of the principles and practices of digital television broadcasting and Internet Technology in a systematic and structured manner will be provided.

Objectives

The objectives of this course are to:
1. explain the history of broadcasting systems and Internet technology;
2. list at least five examples of broadcasting systems and Internet technology;
3. describe at least five basic elements of a broadcasting system;
4. enumerate the different broadcasting regulatory bodies;
5. describe the functions of the different broadcasting regulatory bodies;
6. to design a broadcast station using standard techniques and protocols;
7. evaluate the Internet technology as applicable in broadcasting;
8. identify antennas for radio and television broadcasting;
9. design different internet networks using design principles and standards; and
10. evaluate the designed internet networks.

Learning Outcomes

At the end of the course, the students should be able to:
1. recall the history of broadcasting systems and Internet technology;
2. list five (5) examples of broadcasting systems and Internet technology;
3. explain five (5) basic elements of a broadcasting system;
4. identify five (5) different broadcasting regulatory bodies;
5. describe five (5) functions of the different broadcasting regulatory bodies;
6. identify two (2) techques and two (2) protocols used in the design of broadcasting stations
7. evaluate the Internet technology;
8. identify two (2) antennas for radio and television broadcasting;
9. design an internet network using design principles and standards; and
10. evaluate the internet network already designed.

Course Contents

Prerequisite: UIL-EEE 421. Elements of a broadcasting system. Studio design, acoustic, and equipment. Broadcasting regulations. Frequency spectrum, allocation, assignment and licensing. Regulatory bodies, NBC, NCC, NFMC and ITU. Design, configuration, and services of CATV, MATV, MMDS systems. Transmitter power rating, beamwidth, interference and minimum spacing. Frequency spectrum management of digital and analogue broadcasting. Antenna types for radio, television, and satellite. Analogue and digital audio broadcasting. Analogue and digital television standards. MPEG and DVB. Channel coding techniques. HDTV. Digital television/monitor set, CRT, LCD and Plasma technologies. Internet Technology and architecture. OSI layers, TCP/IP. Internet addressing, IPv4, IPv6. Internet broadcasting, principles, components, standards and applications.

Minimum Academic Standards: As stated in the CCMAS

UIL-EEE 525: Digital Signal Processing (2 Units E; LH = 30)
Senate Approved Relevance
DSP functionalities are embedded in electronic devices and software that touch many aspects of our daily life such as media players and recorders, speech coders and modems in cellular phones, image processors in TVs and digital cameras, GPS navigators, etc. DSP enables information transmission in telephone and communications infrastructures, measurement and control in medical equipment. Therefore, in line with the vision and mission of the University of Ilorin, students should have clear knowledge of signals and systems. Students should understand the reason why Discrete Fourier transform (DFT) is arguably the most important signal analysis tool for all areas of science and technology. To produce electrical and electronics engineers that will be able to fit into the modern engineering industry, there is the need for electrical and electronics engineering students to have sound background in signal and systems analysis and design. The knowledge of the course will go a long way in fulfilling the mission of the University of Ilorin to be an international centre of excellence in learning and research.

Course Overview
This course is expected to expose students to signals and systems. The course exposes students to learn how to analyse data via the Fourier transform and how to convert analogue signal to digital. Students are to be grounded on how to manipulate data via digital filters. The theoretical bases are complemented by applied examples in MATLAB. They will be exposed to how filters are able to pass a portion of a signal while rejecting others depending on the design parameters of the filter. Students will become familiar with the band pass, band reject, low pass, and high pass filters, and acquire knowledge on how to design them.

Objectives
The objectives of the course are to:
1. describe the concept of signals and systems;
2. explain the basic operations on signals and systems;
3. describe the conversion of analogue signals to digital signals;
4. explain the basics of discrete time systems, linearity and time invariant;
5. explain discrete time systems, recursive and nonrecursive realizations;
6. describe the concept and application of z-transform;
7. explain discrete-time Fourier transform;
8. explain the concept of filtering, time-frequency methods and identify the relations between them;
9. describe the design of digital filters for given performance specifications; and
10. describe the design and implementation of a DSP filter using MATLAB.

Learning Outcomes
At the end of this course, the students should be able to:
1. illustrate two (2) concepts of DSP theory such as sampling theory and discrete frequency;
2. execute three (3) basic operations on signals and systems;
3. transform analogue signals to digital signals;
4. explain the basics of discrete time systems, linearity and time invariance;
5. explain Z-transforms and three (3) of its properties;
6. differentiate among DTFT, DFT, and FFT;

7. define the concept of filtering, time-frequency methods and identify the relations between them;
8. differentiate between FIR and IIR filters, stating their frequency response and state three (3) of their characteristics;
9. design and implement FIR and IIR filters using different methods; and
10. demonstrate successfully the design and implementation of DSP filter using MATLAB.

Course Contents

Prerequisite: EEE 311, EEE 322. Overview of signals. Systems and signal processing. Concepts of discrete-time signal processing. Systems necessary for the design and analysis of advanced signal processing technology. Type and selection of ADC/DAC. sampling theorem. Aliasing. Quantization. Noise and coding. Analysis and application of discrete-time signals and systems in transform z-domain. Z-transform. Properties of Z-transform. Transfer stability. Causality. Difference equations. Discrete Fourier analysis and FFT. Discrete time signals and systems. DTFT and IDTFT. Digital filters definitions and types, structure and design. FIR and IIR filters. Software implementation of DSP algorithms. DSP microprocessors. Architecture of DSP microprocessor. Fixed point and floating point DSP. Signal segmentation effect, DSP chips. Practical application of DSP in audio and video.

Minimum Academic Standards: As stated in the CCMAS

UIL-EEE 528: Satellite Communications (2 Units E; LH = 30)

Senate Approved Relevance

In today’s world communication is key, students are expected to be knowledgeable about the different types of communications around them. Satellite communication is the process of communicating via signals that bounce off extra-terrestrial satellites rather than cell towers. Radio signals are received not from the average cell tower but rather from space. It is important that students are well grounded in the several advantages involved and apply them to real life scenarios.

Course Overview

This course is expected to expose the students to satellite communications, its applications and implementation. The course exposes students to rudiments of satellite communications. Students are to be grounded in the design, analysis and troubleshooting of satellite links as well as VSAT networks.

This course provides students with principles of radio communications via the unique attributes of orbiting satellites to understand methods that can be used for data relay and personal communication systems. The knowledge imparted through the course equips the students with skills to identify, understand and apply solutions to communication challenges within diverse subsystems that make up the complete satellite communication system.

Objectives

The objectives of this course are to:

1. explain satellite systems orbits and constellations;
2. determine the azimuth and elevation angles of a satellite from an earth station;
3. explain the propagation of satellite links and baseband communications techniques for satellites including modulation;
4. determine the visibility of a geostationary satellite from an earth station;
5. evaluate communication quality of satellite link signals using signal-to-noise ratio or

bit error rate;
6. calculate link budgets for the uplink and downlink bands at an earth terminal receiver;
7. design a communications satellite system to meet specified system parameters using suitable multiple access techniques for the digital link;
8. determine attenuation effects in a satellite link and suitable antenna types to use on satellite stations to overcome these attenuation effects;
9. describe multiple access techniques and VSAT networks as well as the applications of various satellite communications system;
10. determine bit error rate improvements mechanisms with various error correction coding techniques;
11. design various types and dimensions of antennas for use on satellite and at earth stations; and
12. design satellite communication systems capable of carrying various data types using analogue or digital modulation.

Learning Outcomes

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

1. explain three (3) types of satellite orbits;
2. state four (4) frequency bands used for satellite communication;
3. explain three (3) applications and services of satellite communications;
4. discuss four (4) challenges of satellite communications;
5. list four (4) types of antennas used for satellite communication;
6. calculate the antenna gain, pointing loss and other related parameters;
7. design and troubleshoot the amplifiers needed for satellite communications;
8. design and analyze a basic satellite link;
9. explain modulation and multiplexing techniques used in satellite communication;
10. discuss four (4) multiple access techniques;
11. explain the DTH or Direct to Broadcast satellite systems;
12. discuss two (2) types of VSAT networks, technologies, configurations and polling.
13. explain the mode of operation of the GPS; and
14. discuss digital broadcasting satellite systems.

Course Contents

Introduction to Satellite Communications. Types of satellite orbits (LEO, GEO, etc). Frequency bands. Applications and services. Types of antennas. Antenna gain. Pointing loss. Antenna power gain-to-system noise temperature (G/T) ratio. Effective isotropic radiated power (EIRP). High power amplifiers. Low noise amplifiers. Low-noise block downconverter (LNB). Conversion process. Polarization hopping. Redundancy configurations. Earth station monitoring and control. Link budget. Attenuation. Sources of interference. Carrier to noise and interference ratio. System availability. Frequency reuse. Link budget. Link design. Modulation and multiple access techniques. VSAT networks technologies. Network configurations. Multi-access and networking. Network error control. Polling VSAT networks. GPS. Direct-to-home (DTH) or Direct Broadcast Satellite (DBS) Systems.

Minimum Academic Standards: As stated in the CCMAS

UIL-EEE 541: Power Systems Communication and Control (2 Units E; LH = 30)
Senate Approved Relevance

In an effort to produce graduates of electrical and electronics engineering that are globally competitive, electrical and electronics engineering students should be trained to be

knowledgeable in the area pertaining to power systems communication and control. This will go long way in realising the mission of the University of Ilorin.

Course Overview

This course exposes students to the techniques used in conveying communication signals using existing power line infrastructure as the communication channel. The students will be able to appreciate the merits of PLC communications in the high voltage, medium voltage and low voltage segments.

The students will be exposed to the various power control schemes and how automatic voltage regulation is performed. They will be taught how to design power line communication systems while considering multipath propagation, signal attenuation, noise, and electromagnetic compatibility issues.

Objectives

The objectives of the course are to:

1. explain the block diagram of a power line carrier (PLC) communication system;
2. describe why communication is necessary in power systems;
3. describe the expected characteristics of a good PLCC system;
4. explain the challenges of power line carrier (PLC) communication systems;
5. explain the propagation parameters and power loss of a high frequency communication signal transmitted through a power line;
6. explain the application of PLC communication in the high voltage, medium voltage, and low voltage segments;
7. explain the ultra-narrowband,, narrowband, and broadband frequency bands of PLCs;
8. explain attenuation, multipath propagation, noise, electromagnetic compatibility, and security issues that affects PLC communications;
9. explain the overview of power system control;
10. explain the various control schemes for a given power system; and
11. explain program designs and critical steps to achieving effective automatic voltage regulation.

Learning Outcomes

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

1. describe the block diagram of a power line carrier (PLC) communication system;
2. describe four (4) reasons communications is necessary in power systems;
3. describe six (6) characteristics of a good PLC communication system;
4. describe five (5) challenges of PLC communication systems;
5. determine the propagation parameters and power loss of a high frequency communication signal transmitted through a power line;
6. describe the application of PLC communication in the high voltage, medium voltage, and low voltage segments;
7. describe the ultra-narrowband, narrowband, and broadband PLC frequency bands;
8. describe attenuation, multipath propagation, noise, electromagnetic compatibility, and security issues that affects PLC communications;
9. describe the overview of power system control;
10. interprete various control schemes for a given power system; and
11. analyse programme designs and critical steps to achieving effective automatic voltage regulation.

Course Contents

Prerequisite: UIL-EEE 421, UIL-EEE 445. Review of transmission line theory. Function of communication in power systems. PLCC challenges. High frequency communication on power lines. PLCC injector. PLCC repeater. PLCC extractor. PLCC Modem. Carrier systems. PLCC frequency bands. Multiplexing. Telemetering. Signal processing and data transmission. Control of power generation. Voltage control. System stability. Automatic voltage regulators. Regulating transformers.

Minimum Academic Standards: As stated in the CCMAS

UIL-EEE 542: Power System Protection (2 Units E; LH = 30)

Senate Approved Relevance

In an effort to produce graduates of electrical and electronics engineering that are globally competitive, electrical and electronics engineering students should be trained to be knowledgeable in the area pertaining to power system protection. This will go long way in realising the mission of the University of Ilorin.

Course Overview

Power system protection is a scheme designed to isolate an electrical power system's faulty section so that the healthy portion can function satisfactorily without any severe damage due to fault currents. The protection can be achieved through a fuse, instrument transformer, relay, circuit breaker and surge protection device.

The course intents to make the student an expert in the design and implementation of protection scheme for power system and its component. The understanding of the course will allow the student to become a specialist in the field of protective engineering.

Objectives

The objectives of the course are to:

1. describe the principles of protection;
2. identify faults in a power system;
3. identify different types of protective switchgear;
4. describe the protective relays;
5. describe the basic requirements for a protection system;
6. analyse the symmetrical and unsymmetrical faults;
7. identify circuit breakers and its operation;
8. identify fuse elements;
9. describe the difference between a fuse and circuit breaker;
10. describe the protection of alternators and transformers; and
11. identify reasons for voltage surge in power system.

Learning Outcomes

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

1. explain the protective relaying scheme;
2. describe three (3) different types of fault in power system, symmetrical, unsymmetrical faults etc;
3. describe the symmetrical component method, operator "a", phase current, sequence current, sequence impedance;
4. identify four (4) switchgears used in power system protection, component of switchgear;
5. explain four (4) types of protective relays in power protection, fundamental requirements of protective relay, relay operational principle;

6. explain the arc phenomenon, principle and method of Arc extinction, classification of circuit breakers, resistance switching;
7. describe the characteristic of fuse elements, at least three type of fuse, fuse current capacity;
8. explain four (4) advantages of circuit breaker over fuse;
9. describe the protection schemes for an alternator, differential protection, modified differential protection, balance earth-fault protection;
10. describe Buchhoz relay, circulating current system for transformer; and
11. explain voltage surge and causes.

Course Contents
Faults and concept of protection in power systems. Symmetrical fault analysis on three-phase system. Limitation of fault current. Percentage reactance and base KVA. Short-circuit KVA, control of short-circuit currents. Unsymmetrical faults on three-phase system. Symmetrical components method, operator 'a'. Sequence currents, sequence impedances of power system elements. Analysis of unsymmetrical faults, Single line-to-ground fault. Line-to-line fault. Double line-to-ground fault. Switchgear. Fuses. Circuit breakers. Basic principles of relay design, construction, characteristics and applications. Protective relays. Distance relay. differential relay, etc. Protection of generators, motors. Bus-bars and transformers protection schemes. Sub-station, classification. Equipment in sub-stations and their symbols.

Minimum Academic Standards: As stated in the CCMAS

UIL-EEE 543: Electrical Power System Analysis (2 Units E; LH = 30)
Senate Approved Relevance
In an effort to produce graduates of electrical and electronics engineering that are globally competitive, electrical and electronics engineering students should be trained to be knowledgeable in the area pertaining to power system analysis. This will go long way in realising the mission of the University of Ilorin.

Course Overview
Power system analysis deals with the design of entire power systems consisting of generators, transformers, capacitor banks, shunt reactances and transmission lines. The analysis involves load flow, short circuit fault, and stability studies.
This course is designed to introduce and expose students to the stability process of the power system whenever there is a fault or change in load configuration. They will also be exposed to the concept of load demand and supply as well as load balancing. Through this course, the students will be proficient in the use of software for the analysis of power systems.

Objectives
The objectives of the course are to:
1. describe the modelling of power systems;
2. explain the power load flow calculations;
3. explain Gauss-Seidel, Newton-Raphson methods;
4. describe the operation strategies involved in power networks;
5. explain the effect of the sudden load change on the power system;
6. describe the short circuit fault;
7. explain symmetrical analysis of unsymmetrical faults;
8. explain the system stability;
9. identify software for power system analysis; and
10. explain load forecasting and its relevance.

Learning Outcomes

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

1. identify and model four (4) equipment connected to the power system;
2. describe load flow analysis, and state four (4) advantages and two (2) applications;
3. explain the Gauss-Seidel, Newton Raphson, fast decoupled techniques;
4. explain two (2) methods for system planning and operation, and prediction;
5. describe the consequences of sudden load change, voltage fluctuation which may affect the performance of appliances;
6. explain the short circuit faults, three-phase to earth, phase to phase, single phase to earth, two-phase to earth and phase to phase plus single phase to earth;
7. carryout symmetrical analysis for unsymmetrical faults;
8. explain system power system stability, swing equation;
9. apply two (2) relevant softwares to solve power system analysis problems; and
10. explain load forecasting and mention four (4) load forecasting techniques.

Course Contents

Prerequisite: UIL-EEE 445. Power system modelling. Load flow analysis. Bus admittance matrix. Static flow equations. Method of power flow evaluation. Gauss-Seidel load flow analysis. Newton Raphson load flow analysis. Short circuit faults analysis. Symmetrical component. Classification of system variables. Generalised n-bus system. Network model formulation. Optimum operating strategies. Control strategy. Stability analysis. Swing equation. Steady state and transient stability. Computer application to power system analysis (MATLAB and other relevant software). Load forecast and its techniques.

Minimum Academic Standards: As stated in the CCMAS

UIL-EEE 551: Control Engineering II (2 Units E; LH = 30)

Senate Approved Relevance

In an effort to produce graduates of electrical and electronics engineering that are globally competitive, the students should be trained to be knowledgeable in the area pertaining to control engineering. If our electrical and electronics engineering students take this course, it will go a long way towards ensuring that the vision of the University of Ilorin in becoming an international centre of excellence in learning and research is achieved.

Course Overview

This course exposes students to the basic control actions, automatic controllers, actuators, sensors. Design using various specifications, controller configurations, P, PI, PD and PID controllers, models, characteristics and implementation, tuning of PID controllers.

This course also exposes students to the design of the PID controller using the Ziegler–Nichols rules. In addition, the students will be exposed to the design of PID controller using frequency-domain approach such as Bode, Nichols and root locus methods.

Objectives

The objectives of the course are to:

1. explain Nyquist plots and stability criterion;
2. explain Bode diagrams and stability criterion;
3. discuss PID controller design with Ziegler–Nichols rules;
4. discuss PID controller design with Cohen and Coon method rules;
5. design PID controller using frequency-domain approach using Bode plot;

6. design PID controller using frequency-domain approach using root locus methods;
7. discuss series and parallel compensation methods;
8. discuss computationally optimization approach to obtain optimal parameter values of PID controllers;
9. explain multi-degrees-of-freedom control systems including modified PID control system; and
10. discuss how to apply computer aided analysis tools for designing control systems.

Learning Outcomes

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

1. demonstrate knowledge of Nyquist plots and stability criterion;
2. demonstrate knowledge of Bode diagrams and stability criterion;
3. design two (2) PID controllers with Ziegler–Nichols rules;
4. design three (3) PID controllers with Cohen and Coon method rules;
5. design two (2) PID controllers using frequency-domain approach using Bode plot;
6. design three (3) PID controllers using frequency-domain approach using root locus methods;
7. discuss the series and parallel compensation methods;
8. discuss computationally optimized approach to obtain optimal parameter values of PID controllers;
9. explain multi-degrees-of-freedom control systems including modified PID control system; and
10. apply computer aided analysis tools for designing control systems.

Course Contents

Prerequisite: UIL-EEE 451. Frequency analysis. Nyquist plots. Stability criterion. Relative stability. M– and N– circles. Inverse Nyquist plots. Bode diagrams. Determination of transfer function from asymptotic plot. Nichols chart. Root locus plots. Closed loop response and stability. Series and parallel compensation methods. PID controllers design using Bode method. PID controllers design using Nichols method. PID controllers design using root locus method. Computer aided analysis and design of control systems.

Minimum Academic Standards: As stated in the CCMAS

UIL-EEE 552: Digital Control Engineering (2 Units E; LH = 30)

Senate Approved Relevance

In an effort to produce graduates of electrical and electronics engineering that are globally competitive, electrical and electronics engineering students should be trained to be knowledgeable in the area pertaining to digital control engineering. The knowledge of the course will go a long way in fulfilling the mission of the University of Ilorin to be an international centre of excellence in learning and research.

Course Overview

This course exposes students to how to perform Z-transform on sampled data. They will be able to determine suitable techniques for digital controller design. In addition, they will be able to apply sampling and quantization techniques in the design of digital control systems.

The purpose of the proposed course is to present control theory that is relevant to the analysis and design of computer-controlled systems, with an emphasis on basic concepts and ideas. The control-system design is carried out up to the stage of implementation in the form of computer programs in a high-level language.

Objectives

The objectives of the course are to:

1. explain how to perform Z-transform of sampled data;
2. discuss how to determine suitable techniques for digital controller design;
3. discuss sampling and quantization techniques used to analyse and design digital control systems;
4. discuss how to obtain state-space and input/output representation;
5. explain modern control design methodologies for continuous-time and discrete-time systems;
6. discuss how to design discrete-time controller with input/output approach, polynomial approach and state-space approach;
7. explain use ordinary differential equations and Laplace transformation to model physical systems;
8. discuss how to obtain dynamic responses of linear systems and determine their stability
9. explain the construct root-locus and Bode plots, and apply Nyquist criterion in the context of controller design; and
10. explain how to obtain and manipulate state-space representation of dynamical systems using linear algebra.

Learning Outcomes

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

1. perform Z-transform on sampled data;
2. determine two (2) suitable techniques for digital controller design;
3. discuss the sampling and quantization techniques used to analyse and design digital control systems;
4. obtain state-space and input/output representation;
5. familiarise with modern control design methodologies for continuous-time and discrete-time systems;
6. design of discrete-time controller with input/output approach, polynomial approach and state-space approach;
7. use ordinary differential equations and Laplace transformation to model physical systems;
8. obtain dynamic responses of linear systems and determine their stability;
9. construct root-locus and Bode plots, and apply Nyquist criterion in the context of controller design;
10. obtain and manipulate state-space representation of dynamical systems using linear algebra; and
11. design three (3) digital control systems.

Course Contents

Prerequisite: UIL-EEE 451, UIL-EEE 453. Introduction - Issues relating to digital control. Design process. Sampling Theory – Aliasing, Zero-Order Hold (ZOH). z-Transform and Difference Equations. Representation of Sample Data Systems - Pulse Transfer Function. Representation - State Space Representation. Analysis of Sampled Data Systems. Stability. Sensitivity and Robustness. Controllability/ Observability. Pole/Zero Cancellation. Design of Discrete-Time Controller - Input/Output Approach. Emulating Continuous-Time Controller. Invariant Methods. Direct Design. Design of Discrete-Time Controller. Polynomial Approach. Problem Formulation. Pole Placement Design. Model Matching Problem. Design of Discrete-Time Controller, State Space Approach. State Feedback. State Estimation (Observer). Observer Based Compensator. LQ

Optimal Control. LQG Control. Special Topics - LMI formulations of control, feedback linearization, nonlinear observers, and model predictive control. Implementation Issues.
Minimum Academic Standards: As stated in the CCMAS

UIL-EEE 554: Nonlinear Control Systems (2 Units E; LH = 30)
Senate Approved Relevance
In an effort to produce graduates of electrical and electronics engineering that are globally competitive, electrical and electronics engineering students should be trained to be knowledgeable in the area pertaining to nonlinear control systems. The knowledge of this course will go a long way in fulfilling the mission of the University of Ilorin to be an international centre of excellence in learning and research.

Course Overview
This course is an introduction to the foundations of nonlinear control theory, with an emphasis on feedback stabilization. As needed, topics from differential geometry and other mathematical disciplines are introduced to support the development of basic concepts. The focus of the course is on mathematical tools for the analysis and design of nonlinear feedback systems, not the hardware and software technology required for their implementation.
This course exposes students to the various methods used in analysing the structure of nonlinear feedback systems as well as those used for analysing the behaviour of nonlinear feedback systems. The students will be proficient in basic design techniques, including feedback linearization, feedback passivation, Lyapunov design, backstepping, and forwarding. This course exposes students to state variable feedback controller design, controllability, observability, eigenvalue placement, observer design for linear systems. More so student would have the knowledge of non-Linear control systems, the sources of non-linearity, mathematical description of non-linear systems.

Objectives
The objectives of the course are to:
1. discuss methods for analysing the structure of nonlinear feedback systems;
2. explain methods for analysing the behaviour of nonlinear feedback systems;
3. discuss the basic design techniques for feedback linearization;
4. discuss the basic design techniques for feedback passivation;
5. discuss Lyapunov design;
6. discuss backstepping, and forwarding;
7. explain the basics of adaptive control systems;
8. explain the basics of robust control systems;
9. explain the basics of predictive control; and
10. explain neural network and fuzzy control system.

Learning Outcomes
At the end of this course, students should be able to:
1. discuss four (4) methods used for analysing the structure of nonlinear feedback systems;
2. explain three (3) methods for analysing the behaviour of nonlinear feedback systems;
3. discuss the basic design techniques for feedback linearization;
4. discuss two (2) basic design techniques for feedback passivation;
5. discuss Lyapunov design;
6. explain backstepping, and forwarding;
7. explain the basics of adaptive control systems;
8. discuss the basics of robust control system;

9. explain the basics of predictive control; and
10. discuss neural network and fuzzy control system.

Course Contents

Prerequisite: UIL-EEE 451. Introduction to nonlinear control systems. Types of nonlinearities. Describing function. Phase plane, and limit cycle. Nonlinear models and stability. Nonlinear differential equations. Stability of equilibria. Stability of invariant sets. Stability for systems with inputs. Feedback linearization. Controllability. Feedback equivalence. Relative degree. Differential flatness. Stabilization. Control Lyapunov functions. Backstepping. Forwarding. Dissipativity. LQ Optimal Control. Adaptive control. Robust control and model predictive control. Introduction to neural network. Introduction to Fuzzy control system.

Minimum Academic Standards: As stated in the CCMAS

ACADEMIC REGULATIONS

Regulations guiding the conduct of students on the campus are as stated in the University Undergraduate Academic Programme and the Students' Information and Regulations Handbook. Students of this Department are advised to consult these documents and comply with them as stated.

ACADEMIC INFORMATION

Admission Requirements

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

1. Unified Tertiary Matriculation Examination (UTME) Mode (5 Year Degree Programme)
2. Direct Entry(DE) Mode (4 Year Degree Programme)

Unified Tertiary Matriculation Examination (UTME) Mode

For the five-year degree programme, in addition to acceptable passes in the Unified Tertiary Matriculation Examination (UTME), the minimum admission requirement is credit level passes in Senior Secondary Certificate Examination (SSCE) in at least five subjects, which must include English Language, Mathematics, Physics, Chemistry and other acceptable science subjects at not more than two sittings.

Direct Entry (DE) Mode

For the four-year Direct Entry, in addition to five (5) Senior School Certificate (SSC) credit passes, which must include English Language, two must be principal subjects at Advance GCE Level or NCE and its equivalent. Holders of upper credit level at HND are eligible for consideration for admission into 300 level.

Graduation Requirements

The following regulations shall govern the conditions for the award of a honours degree. Candidates admitted through the UTME mode shall have registered for at least 150 units of courses during the 5-year degree programme. Candidates must have registered and passed all the compulsory courses specified for the programme.

The EEE programme shall be run on the modularised Course Unit System. All courses should therefore be sub-divided into more or less self-sufficient and logically consistent packages that are taught within a semester and examined at the end of that particular semester. Credits are weights attached to a course. One credit is equivalent to one hour per week per semester of

15 weeks of lectures or three hours of laboratory/studio/workshop work per week per semester of 15 weeks.
The determination of the class of degree shall be based on the Cumulative Grade Point Average (CGPA) earned at the end of the programme. The CGPA shall be used in the determination of the class of degree

Areas of Study
The Department runs three options as follows:
- Computer and Control Engineering
- Electrical Power and Machines
- Electronics and Telecommunications

Courses in these options are available at the final year i.e. 500 level.

Industrial Training
The Industrial Training aspect of the degree programme is divided into four parts. The first part is the Student Work Experience Program (SWEP) which is held at the end of the 200-level, just during the end of-session break in the Faculty's workshops and laboratories. During this programme students are exposed to workshop practice and have a "hands-on" experience of practical engineering. This serves as a channel for integrating in-house entrepreneurial development and skill into our programme.
The three other parts expose the students to real-life situations in engineering or related establishments within and outside the country. The second part normally takes place during the long vacation after 300 level and lasts for three months while the third part of the training takes place during 400 level Rain Semester and the long vacation which lasts for six months. The last part of the training takes place in the first two weeks of 500 level harmattan semester, which is called Community Based Experience Scheme (COBES), whereby students are grouped into different nearby villages to allow them understand the connections between their technical projects and community-based issues. The Department has recorded impressive growth in the area of academic, administrative, staffing and infrastructures.

Registration for Courses
Courses for the session are registered for on-line at the beginning of the session. In addition, a student is required to go to his level adviser after the on-line registration in order to complete the registration process. Failure to register before the deadline, as stipulated by the university, may result in loss of that session or voluntary withdrawal from the programme. A student cannot re-register for a course already passed.

Requirements to Proceed from 100 to 200 Level
In order for a student to proceed from 100 Level to 200 Level in the Faculty of Engineering and Technology (FET), the following minimum requirements must be met at the end of 100 Level:

(a) Satisfy the 9-9-8 requirement, meaning that a student must pass
- 9 credits of Mathematics
- 9 credits of Physics, and
- 8 credits of Chemistry.

(b) Attain a minimum cumulative grade point average of 2.00.

Standard of Tests and Examinations
Examination questions are set by the lecturer(s) assigned to teach the courses. It is mandatory for the examination questions in all courses to be internally reviewed, and in addition, to be externally

moderated in case of 500 level courses. Lecturers submit their question papers along with model answers and marking guide under strict confidential cover to the Head of Department (the departmental Chief Examiner) who, together with the concerned lecturer and his sectional head, reviews each question paper to ensure that it conforms to standard. Once satisfactorily reviewed and corrected, the question papers are processed under strict confidentiality, by the Head of Department, with the assistance of the departmental Examination Officer and kept in safe custody by the Examination Officer, pending a few hours before the time of the examination. Final year examination questions are particularly moderated by External Examiners who are seasoned, experienced and long-standing professionals in various fields of Electrical and Electronics Engineering. At the end of every session, External Examiners are invited to vet question papers, results, project reports and conduct a project defense for final year students in the department.

Regulations Governing the Conduct of University Examination

(A) Eligibility

All students who are duly registered for courses in a given semester are eligible to sit for examinations in those courses except students in the following categories:

a. A student who absents himself/herself from the University for upward of six weeks in any semester without official permission and thus deemed to have withdrawn from the University;
b. A student who failed to attend up to 75% practical/Lecture hours.

(B) Instructions to Candidates:

i. Students shall always ensure that they acquaint themselves with the examination regulations and instructions to candidates.
ii. Candidates shall attend punctually at the time scheduled for their papers. Candidates arriving more than half an hour after the examination has started shall be admitted only at the discretion of the Chief Invigilator.
iii. Candidates shall bring with them to the examination hall their own ink, pens, rulers, erasers and pencils, and any other materials which are permitted by these regulations (as stated hereunder). Accordingly, candidates are warned in their own interest to ensure that lecture notes, textbooks, jotters, bags, mobile phones, and other related prohibited items are not brought into the examination venue. Students are advised to keep their mobile phones completely away from the venue of the examination, as the University would not take responsibility for loss of such.
iv. To ensure orderliness in the examination hall, seats shall be arranged according to the number of groups taking examinations at each particular time and candidates shall not enter the hall until they have been checked of their identity cards and other relevant documents. Candidates shall keep strictly to the sitting arrangements to avoid confusion. Chairs arranged in the halls used for examination purposes should not, under any circumstances be removed. Candidates wishing to do some revision before the examination shall do so outside the examination hall.
v. While the examination is in progress, communication of any kind between/among candidates is strictly prohibited and any candidates found to be giving or receiving irregular assistance commits an act of misconduct and shall be liable to face disciplinary action.
vi. Silence shall be observed in the examination hall. The only permissible way of attracting attention of the invigilator is by show of hand.
vii. The use of scrap paper, writing or jotting on question paper is prohibited. All rough work shall be done in the answer booklet and crossed neatly through. Supplementary answer sheets, which shall not be supplied until half an hour after the commencement of the examination, shall be tied inside the main answer booklet even if they contain only the rough work.

viii. Candidates taking Mathematics or Engineering Drawing and similar courses shall bring their own Mathematical or drawing instruments, which may include compass and dividers, protractors, diagonal scales and set squares. Personal copies of Mathematical Tables shall not be allowed in the examination hall (see regulations 16 (B) (xiii).

ix. Before handing in their scripts at the end of the examination, candidates shall satisfy themselves that they have inserted at the appropriate place their matriculation numbers and the numbers of the questions answered. Except for the question paper and any other materials, they may have legitimately brought with them (as indicated in rules B (iii) and (viii) above, candidates shall not be allowed to remove or mutilate any paper or material supplied by the University.

x. Candidates shall use their matriculation numbers for examinations. (Candidates who are in doubt of their correct matriculation numbers are advised to confirm from the Senate and Examination Office).

xi. Student shall remain seated while invigilators go from row to row to collect answer scripts.

xii. Candidates shall write their names, matriculation numbers, department and sign against them on the attendance sheet.

xiii. Students intending to use calculators in any University examination should observe the following regulations:

xiv. Candidates shall be permitted the use of electronic calculators except programmable ones. Ignorance as to whether a calculator is programmable or not will not be acceptable.

xv. The calculator must be small (hand held) battery/solar operated, and mobile phone is not allowed;

xvi A candidate shall not borrow another candidate's calculator during the examination as this practice shall be considered as giving or receiving irregular assistance during the examination;

xvii. Instruction manuals are prohibited (as these often contain useful mathematical formulae and methods);

xviii. On entry into the examination venue, the calculator shall be switched off and its memory be made blank;

xix .Only one calculator per student is allowed.

xx. Candidates shall make available for inspection by invigilators, their calculators on entry into the examination hall and at any time during the examination; and

h. A contravention of any of these regulations shall be treated as examination misconduct.

(C) Examination Code of Conduct, Offences and Penalty

i. Code of Conduct:

Candidates shall:

a. use or consult, during an examination only such books, paper, instruments or other materials or aids as are specifically permitted or provided by the University;
b. not introduce or attempt to introduce into examination venue hand bags, books, notes, mobile phone, instrument or other materials or aids that are not permitted;
c. not enter any examination venue with any inscription on any part of the body e.g. palm, arm, thigh, etc. and/or any material if such inscriptions bear any relevance to the examination;
d. not pass or attempt to pass any information from one person to another during an examination;
e. neither act in collusion with any other candidate(s) or person(s) nor copy nor attempt to copy from another candidate, nor engage in any similar activity;
f. not disturb or distract any other candidate(s) during the examination;
g. not be allowed to leave an examination venue until after 75% of the time allocated for that particular paper has expired;

h. not use other people to sit for any University Examination on their behalf;
i. not smoke in the examination hall; and
j. not to be in possession of incriminating material(s) either used or not at the examination or involved in any other serious examination misconduct including impersonating before, during or after an examination.
k. in the case of CBT examinations, candidates must be orderly and abide by the rules or guidelines prevailing at the centre.

Failure to observe any of the rules (a) to (k) above shall, prima facie, constitute examination misconduct.

ii. **Procedure for investigating alleged Examination Misconduct**

a. At the discretion of the Chief Invigilator, a candidate may be required to leave the examination venue when his/her conduct is judged to be disturbing or likely to disturb the examination. The Chief Invigilator shall report any such action taken to the Dean through the Faculty Examination Coordinator immediately after the completion of the examination by other candidates.
b. Any candidate suspected of any examination irregularity shall be required to sign and submit to Chief Invigilator a written statement in the Examination hall. Failure to make a written statement shall be regarded as an admission of the charge against such a candidate.
c. The Dean shall, within 48 hours of receiving a report, set up a panel of not less than three academic staff to investigate the alleged examination misconduct. The report of such investigation shall be made available within two weeks through the Deputy Registrar (Academic) to the Registrar who shall on the basis of the recommendation(s), determine whether or not the matter should receive the attention of the Student's Disciplinary Committee.
d. The Student's Disciplinary Committee shall, within two weeks of receiving such a report, investigate and recommend the penalty in cases of proven misconduct to the Vice-Chancellor in accordance with section 17 of the University Act.

iii. **Penalty**

Any student found guilty of the offences contained under section 2.7.1 (B) (xiii) – a-h and section (C) (a) - (k) shall be expelled from the University.

(D) **Examination Leakage**

Where the Dean has reason to believe that the nature of any question or the content of any question paper may have become known before the date and time of the examination to any person(s) other than the examiners and any official of the University authorized to handle the examination question paper, he may order the suspension of the examination or cancellation of the question paper or the setting of a new paper. He shall then investigate the leakage and report the matter to the Vice-Chancellor.

(E) Absence from Examination

a. Candidates shall present themselves at such University examination for which they have registered under these regulations. Candidates who fail to do so for reasons other than proven ill-health, accident or any emergencies shall be deemed to have failed the particular examination. Misreading of the time-table and such other excuses shall not be accepted as a satisfactory explanation for absence.
b. A student who falls ill during examination periods should report in writing to the Dean of his/her Faculty through his/her Head of Department.

(F) Make-Up examinations

i. A student who is absent from an examination on account of ill-health confirmed by medical evidence from the Director of University Health Services, may be given a make-up examination in the course(s) missed: otherwise, he/she shall repeat the course concerned if he/she so desires but subject to the status of the course.

ii. Approval for make-up examination shall be by Faculty Board indicating that:
   a. the ill-health has been reported to the Dean through the Head of Department and

b. the candidate has obtained a report from the Director of Health Services or his designated officer which either:

i. is dated prior to the end of the examination, or

ii. provides evidence that the student was hospitalized during the period of examination.

iii. A "Make-Up" Examination is an examination specially arranged for a student or group of students who could not sit for the normal examination due to ill-health or any other unavoidable circumstances. Each case will however, be treated on its merit.

(G) Determination of results

A candidate shall be deemed to have passed a first-degree examination if he/she has satisfied the Senate in all the requirements for the examination (including all GNS courses).

Grading System

The University operates a 5-point grading system in which the continuous assessment takes 30% and examination 70% in each course for each semester. The Continuous Assessment is made up of class quizzes, test(s), assignments, reports as applicable. In addition, a student must satisfy a minimum of 75% attendance at lectures before being qualified to sit for examination in the respective course.

The range of scores and the corresponding letter grades are as shown in Table 2.1.

Table 2.1 Range of scores and the corresponding letter grades

Grade	Grade Point	Percentage Scores (%)
A	5.0	70 - 100
B	4.0	60 - 69
C	3.0	50 – 59
D	2.0	45 – 49
E	1.0	40 – 44
F	0	0 – 39

Classification of Degrees

The Bachelor of Engineering (B.Eng.) degree in Electrical and Electronics Engineering is awarded in the First Class, Second Class Upper Division, Second Class Lower Division and Third Class, depending on the Cumulative Grade Point Average (CGPA) at the point of graduation and as shown in Table 2.2.

Table 2.2 Classification of Degrees

Class of Degree	Range of C.G.P.A.
First Class	4.50 – 5.00
Second Class Upper	3.50 – 4.49
Second Class Lower	2.40 – 3.49
Third Class	1.50 – 2.39

University Library

A. **Office Hours**

The University of Ilorin Library operates in the following locations, Main Library, Faculty of Engineering and Technology Library and e-Library within the campus. The Library is open to students upon proper registration with the Library. The opening hours are:

Monday – Friday	-	8.00 am – 10.00 pm
Saturday	-	8.00 am – 1.00 pm
Sunday	-	5.00 pm – 10.00 pm

The Library is closed on Public Holidays. The University Librarian shall reserve the right to extend the operation hours during examination period as may be deemed fit. Currently, the Library is open 24 hours around examination periods.

University Health Services

The University has a well-equipped Health Centre where students must register as part of the normal registration exercise and, in any case, not later than **two months** of their arrival on campus. The Student Medical Examination and registration is **MANDATORY** and is required for students who may request for:

Make Up Examination or Tests,
Treatment at the University Health Services Unit, and
Clearance before NYSC Service year.

JOB OPPORTUNITIES

Graduates of the Department of Electrical and Electronics Engineering of University of Ilorin, by training, could comfortably fit into various work areas. Some of these areas are listed below.

(a) Design Engineering
- Consumer Electronics: TV, VCRs, CD players, stereo equipment and gaming devices
- Computer Equipment: motherboards, printers, scanners, processors, monitors
- Power Generation, Transmission and Distribution systems
- Communications Devices: transmitters, receivers, transceivers, networks
- Manufacturing Processes: programming, machine control, plant design
- Reliability and Maintainability of engineering systems

(b) Manufacturing Engineering
- Plant Engineering: servicing and offering support in industrial environment
- Power Engineering: safe, reliable and sustainable power delivery
- Information Systems: support to manufacturing processes

(c) Analysis and Testing Engineering
- Technical Service Engineering: troubleshooting, maintenance and repair
- Product Testing for quality, safety, performance of equipment

(d) Sales
- Sales Engineering for manufacturers of electrical/electronic/telecommunications equipment

(e) Information and Communications Technology

(f) Oil and Energy industries

(g) Research and Development (R & D)

- Product Development
- Research to discover/develop new materials and technologies
- Training

APPENDIX

Appendix I: List of Reviewers (NUC 70%)

1. Prof.   Y. A. ADEDIRAN

Appendix II: Senate Committee on 30% Delivery for UNILORIN CCMAS

1. Prof. O. A. Omotesho - Chairman
2. Prof. G. T. Arosanyin - Director, Academic Planning Unit
3. Prof. M. O. Yusuf
4. Prof. L. A. Yahaya
5. Prof. A. C. Tella
6. Prof. A. A. Baba
7. Prof. A. A. Adeoye
8. Prof. Omenogo V. Mejabi
9. Prof. O. A. Lasode
10. Prof. M. S. Ajao
11. Prof. G. B. Adesiji
12. Ebunoluwa O. Osagbemi
13. Taiwo K. Afolayan
14. A. G. Dauda
15. I. Dauda
16. Omobukola G. Omotoye - Secretary
17. A. A. Lawal - Co-Secretary

Appendix III: Members of the Programme Working Group

1. Prof. G.T. Arosanyin
2. Dr. S. B. Akanbi
3. Dr. A. A. Kilishi
4. Dr. M. F. Ajide
5. Dr. H. A. Yusuf