

**STATE UNIVERSITY OF MEDICAL AND APPLIED
SCIENCES (SUMAS), IGBO-ENO, ENUGU STATE**



Faculty of Engineering and the Built Environment

**Department of Electrical and Electronic Engineering
(EEE)**

**DEPARTMENTAL HANDBOOK
(UNDERGRADUATE PROGRAMME)**

2024

**STATE UNIVERSITY OF MEDICAL AND APPLIED
SCIENCES(SUMAS), IGBO-ENO, ENUGU STATE**



Faculty of Engineering and the Built Environment

**Department of Electrical and Electronic Engineering
(EEE)**

**Five-Years Standard Undergraduate Bachelor of
Engineering (B.Eng.) Degree Programme in Electrical
and Electronic Engineering**

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Past and Present Vice- Chancellor of SUMAS

S/N	Names	Dates
1	Prof. James Chukwuma Ogbonna	2022 -Date

Past and Present Deans of Engineering and the Built Environment

S/N	Names	Dates
1	Prof. L. U. Anih	2022-2024
2	Prof. F. U. Asoiro	2025-Date

Past and Present Head of Department Electrical and Electronic Engineering

S/N	Names	Dates
1	Engr. Dr. D. C. Ezema	2024-2026
2	Engr. Dr. S. S. Okika	2026- Date

**STATE UNIVERSITY OF MEDICAL AND APPLIED SCIENCES, IGBO-ENO,
ENUGU STATE, NIGERIA
FACULTY OF ENGINEERING AND BUILT ENVIRONMENT
DEPARTMENT OF ELECTRICAL AND ELECTRONIC ENGINEERING**

Philosophy of SUMAS

The University is fully committed to efficient time management skills which are critical for students and lecturers alike in teaching and learning processes. Allocating realistic amount of time means effective learning for student and effective teaching for lecturers. How an institution defines time expectations for student, lectures, administrations, and other professional staff can establish the basis for high performances for all. Time on task will be a principle that applies to all person within, and all components of, an institution. The university will therefore consider student time on task (learning), lecturer time on task (teaching), and institutional time on task (devoted to teaching and learning). Student typically will have heavy course-hour requirement, and the University will expect a tremendous amount of work outside class in preparation for each hour. For lecturers, the University will ensure that individual teachers themselves commit sufficient time to the institutional task. Teachers are powerful role model for their student. The simple matter of starting and ending class on time can send important messages about how professors and profession view and use time. Corresponding efforts may be required to ensure the students are timely in their own class attendance. Lecturers will be expected to prepare conscientiously for class and employ teaching methods appropriate for the subject matters and objective of their courses. The objectives and requirement of their courses, including applicable attendance and grading rules, will be clearly stated.

The university is fully committed to devoting adequate resources to teaching. The University will actively compete for funds that are appropriated to support teaching enhancement and improvement, multidisciplinary teaching and collaborative teacher-student efforts. Private donors may be quite interested in programmes to enhance teaching. While donors have traditionally supported teaching through such gifts as endowed chairs, in recent years private funds have been successfully raised for other teachings initiatives. The university will develop a principles and practice programme, in which practicing professionals team-teach upper-level courses with fulltime lecturers. Students will learn from both the practitioners and the professors and members of the teaching-team learn from each other. The university will seek a donor to endow the programme, as well as donors to support lecturer-practitioner teams in individual principles-and-practice courses.

Not only will the University focus on ways in which individual students and teachers can become more focused on appropriate tasks; the lecturers should also consider the institutional structure in which teaching, and learning occur. Lecturers will consider the impact of the University's curriculum on their efforts to make the most of efficient use of student and staff time. The University will, furthermore, make

efficient use of student time by careful curriculum planning. Moreover, the University will review its curricula regularly in with global best practices and to consider the needs of the stakeholders in our rapidly changing society.

Care Values

As operating ethos, the following values are prioritized to underlie the University's mission. These values serve as the foundation for commitment of the University as a tertiary institution focusing on health sciences, technology, and legal studies to provide a more equitable and inclusive atmosphere for education, practice and research while envisioning both personal enhancement and social progress.

Respect: Vicissitude of ideas leads to gaining a trenchant perspective; thus, the university will respect diverse scientific approaches of its community members.

Communication: In pursuit of sustaining its leadership role, the university will exhort scholars to exchange ideas, and create an effective communicative environment. To serve its global vision, the university will also attempt to excel its international relations and communicate its scholarly views worldwide.

Diversity: The University will endeavor to be home to people from different walks of life. Diversity fosters a productive academic atmosphere, promoting the university's mission and enriches a greater creative environment. Being hospitable to diverse backgrounds will strengthen understanding of each other.

Teamwork: Every department and division of the university will be called for synergy to boost both the university resourcefulness and scientific progress.

Unity: Although the university is deemed a platform for the plethora of options, a home to diverse people and a forum to exchange divergent ideas, it is viewed holistically and as an entity which attempts to become united with others across the globe.

Excellence: In teaching, research, and public service, excellence will be observed to utilize the available to create new ones and to ensure quality delivery.

Innovation: Consistently seeking noble approaches to healthcare systems, engineering, technology, and research will be among the focal values to positively impact practice and experience the university.

Compassion: Compassion will be one of the university's true hallmarks reflected into the university's humanitarian attitude in sympathizing with those suffering, standing with them in their suffering and endeavoring to alleviate their pains.

Service: Commitment to the wellbeing of the national community and any other person the university encounters will compel the university to provide the people with state-of-the-art service.

Respect for the national environment: The university recognizes human impact on environment and ramifications that they shall consequently incur. The university, therefore, understands its responsibilities towards nature and values ecological solutions and interdisciplinary practices to ameliorate environmental degradation or diminish the negative results of the activities the university may cause.

Integrity: honesty and truth will pervade the university words and deeds and serve as the basis for every decision the university will make.

Vision

The vision of State University of Medical and Applied Sciences is “to be a leading university of excellence in medical and applied sciences. The university will accelerate progress as an international leader in medical and applied sciences. It will empower its students to fulfill their academic and professional passions in a university that is welcoming and inclusive for all students, lecturers, and professional staff. The University will create innovative connections among medical, health, natural and applied sciences, and engineering. It will strengthen support for dynamic set of lecturers dedicated to teaching, mentoring, research, clinical care, engineering services and technology

Mission

The mission of the University is to provide a learning environment in which staff and student can discover, examine critically, preserve, and transmit the knowledge, wisdom and values that will help ensure the survival of this and future generations and improve the quality of life for all. The University will seek to help student to develop an understanding and appreciation for complex cultural and physical worlds in which they live and to realize their highest potential of intellectual, physical, and human development.

Goal and Objectives of the University

The state university of medical and applied sciences shall be firmly committed to offering students of widely varied ages, backgrounds, interests and needs, a broad range of educational opportunities and experiences.

The objectives of the university shall be, to:

(a) Provide a wide range of quality learning opportunities for undergraduates and postgraduate students without distinction of race, creed, sex, religion, or political convictions that will enhance their best intellectual, social, and personal development.

- (b) provide academic, professional, and vocational training of high quality in a way as to enrich and improve state, national and international human resource capabilities and assist its graduates to contribute to the common good of the society.
- (c) foster academic research which contributes to human knowledge and the vitality of the institution.
- (d) Encourage thoughtful and responsible staff and students' participation in local, state, national and international affairs.
- (e) Maintain the highest academic standards in respect of university degrees and other awards and preserve and protect their reputation and integrity.

PRINCIPAL OFFICERS OF THE UNIVERSITY

VICE CHANCELLOR

Prof. James Chukwuma Ogbonna
B.Sc. (Jos); M.Eng. (Yamanashi); Ph.D. (Tsukubai)

REGISTRAR

Mr. Anselm U. Onah
B.A. Ed. (Hons); FCAI; FIIA; MANUPA

UNIVERSITY LIBRARIAN

Dr. Monica E. Eze
CLN; FNLA; FCAI

BURSAR

Dr. Ozoadibe Elvis Emeka
B.Sc., MBA' M.Sc.; Ph.D.; FCA; ACTI; MILRM

LIST OF ACADEMIC STAFF

S/N O	NAMES	Area of specialization	Discipline	Qualification	Rank
1	Engr. Dr. Ezema Donatus Chukwudi Email: donatus.ezema@sumas.edu.ng	Communication Engineering	Electrical and Electronic Engineering	PhD	Lecturer I
2	Engr. Dr. Okika Sunday Stephen. Email: Sunday.okika@sumas.edu.ng.	Control and Instrumentation	Electrical and Electronic Engineering	PhD	Lecturer I
3	Engr. Dr. Aneke Ezekiel Nnamere	Power System Engineering	Electrical and Electronic Engineering	PhD	Senior Lecturer
4	Engr. Dr. Ogbodo Ikechukwu Ogbodo	Power System Engineering	Electrical and Electronic Engineering	PhD	Lecturer I
5	Rev. Fr. Engr. Dr. Edward Anoliefo	Electronic Engineering	Electronic Engineering	PhD	Visiting Senior Lecturer
6	Engr. Dr. Asanya O. N.		Electrical and Electronic Engineering	PhD	Visiting Senior Lecturer
7	DR. Egbonwonu Emmanuel Livinus	Communication Engineering	Electrical and Electronic Engineering	PhD	Lecturer I
8	Engr. Dr. Nwaogaidu Simeon. O	Power System Engineering	Electrical Engineering	M. Eng	Lecturer I
9	Dr. Udeagbala Remigius Ndidika	Machines	Electrical and Electronic Engineering	PhD	Lecturer II

10	Engr. Dr. Enyi Valentine Sunday	Industrial Electronics and Power Devices	Electrical Engineering	PhD	Lecturer II
11	Engr. Eze Raphael Chijioke	Communication Engineering	Electronic Engineering	M. Eng	Lecturer II
12	Engr. Ugwuanyi Sylvanus Ugochukwu	Power System and High Voltage Engineering	Electrical Engineering	M. Eng	Lecturer II

List of Technologists

S/N O	NAMES	Area of specialization	Discipline	Qualification	Rank
1	Mr. Eze Ikechukwu	Power and Machine	Electrical and Electronic Engineering	HND	Technologist II
2	Mr. Madubuko Bonaventure Chinedu	Solar Installation and Repair	-----	WAEC	Laboratory Assistant

LIST OF SUMAS CCMAS TECHNICAL REVIEWER COMMITTEE

Prof. Emmanuel Ike UGWUJA (**Senate Chairman CCMAS**)

Prof. L. U. Anih (**Chairman Technical Reviewer**)

Engr. Dr. D.C. Ezema (**Member**)

Engr. Dr. S.S. Okika (**Member**)

Mr. Eze Ikechukwu (**Member/Acting CCMAS Secretary**)

State University of Medical and Applied Sciences, Igbo-Eno, Enugu State, Nigeria
Faculty of Engineering and Built Environment
B.Eng. Electrical and Electronic Engineering

Programme Description and Brief Profile:

The Department of Electrical and Electronic Engineering hosts the Bachelor of Engineering Degree programmes in Electrical and Electronic Engineering of the State University of Medical and Applied Sciences. It came into existence with the enactment of the University Act by the Enugu State House of Assembly in 2022 and was conceived as inception courses in the drawing up of the academic programmes for the new university. The programmes commenced in 2022/23

session. The first set of Academic and support Staff were recruited through a competitive process. The Department strives to operate at the cutting edge of the curriculum on offer. The Department of Electrical and Electronic Engineering offers a very attractive Bachelor of Engineering (B.Eng) programme of five-year duration. The programmes set out to give the undergraduate a firm academic foundation in the scientific principles upon which Electrical Engineering and Electronic Engineering are based, then introduces him to the technological applications of these fundamental scientific principles and finally grooms him to develop the professional capability for carrying out such applications. The teaching of Engineering at the State University of Medical and Applied Sciences (SUMAS), Igbo Eno started in November 2022.

Overview

Electrical and Electronic engineers are involved in channeling natural resources into various end-uses such as in heating, lighting, home appliances, consumer products, computing, sensing, control, and communication systems. They contribute to the development of systems and devices for power, instrumentation, measurement, communication engineering, management, manufacturing, transportation, etc. They are primarily concerned with the processes of generation, transmission, transformation, control, and utilization of energy and/or information.

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

1. electrical circuits and electronic provide study of basic electrical devices – energy sources, resistors, inductors, capacitors, diodes, and transistors – and their interconnection in operational networks. Circuit analysis and design techniques cover both analogue and digital applications;
2. power systems emphasize the design and applications of motors, generators, transformers, distribution systems, high-voltage devices, and power electronic;
3. control systems emphasize the design and application of circuits and systems to automatically monitor and regulate operation of devices, machines, and processes. Advanced technologies using digital control, intelligent processing, neural networks, and programmable logic controllers are included;
4. communication systems and signal processing cover concepts required for the characterization and manipulation of information-bearing signals, modulation systems, wireless networks, image processing, and signal detection software and hardware. These courses provide instructions in the interaction, propagation, and transmission of high frequency waves and signals through space and in conductors. Topics include grounding and shielding, antennas, microwaves, and systems; and

5. optics and optical devices provide a study of solid-state materials, electronic devices, and optoelectronic. Applications are in micro-fabrication, telecommunications, computing, instrumentation, lasers and fiber optics, sensing, and smart technologies.

Philosophy of B.Eng. Electrical and Electronic Engineering

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 organizational 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 Electronic 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 specialized 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	Analyzing, 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)	Produce development; Research to discover/ development new technologies; training.

Admission and Graduation Requirements

Admission Requirements

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

3. Unified Tertiary Matriculation Examination (UTME) Mode (5 Year Degree Programme)
4. 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 an honour 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 modularized 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

Global course Structure

100 Level

First 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	2	C	45	-
CHM 107	General Practical Chemistry I	1	C	-	45
MTH 101	Elementary Mathematics I: (Algebra and Trigonometry)	2	C	30	-
PHY 101	General Physics I: (Mechanics)	2	C	30	-
PHY 103	General Physics III:(Behaviour of Matter)	2	C	30	-
PHY 107	General practical Physics I	1	C	-	45

SUMAS -GET 109	Environmental awareness and protection	2	C	30	-
SUMAS- COS 101	Introduction to Computer Application	2	C	30	-
	Total	17			

Second 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	2	C	-	45
CHM 108	General Practical Chemistry II	1	C	-	45
MTH 102	Elementary Mathematics II: (Calculus)	2	C	30	-
PHY 108	General Practical Physics II	1	C	-	45
EEE 102	Introduction to Electrical and Electronic Engineering	2	C	30	-
SUMAS -PHY 104	General Physics IV:(Vibration, Waves and Optics)	2	C	30	-
SUMAS -GET 106	Applied Mechanics	2	C	30	-
SUMAS-GET 108	Occupational Safety	2	C	30	-
	Total	18			

200 Level

First 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 Modelling II	3	C	45	-
GET 205	Fundamental of Fluid Mechanics	3	C	45	-
GET 209	Engineering Mathematics I	3	C	45	-
GET 211	Computing and Software Engineering	3	C	30	45
SUMAS- MEE 243	Measurement and Instrumentation	3	C	45	-
	Total	20			

Second 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	-
GET 208	Strength of materials	3	C	45	-
GET 202	Engineering Materials	3	C	45	-
EEE 202	Applied Electricity II	3	C	30	45
EEE 204	Electrical Engineering Materials	3	C	45	-
SUMAS – GET 214	Engineering Economics	2	C	30	-
	Total	24			

300 Level

First 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 Electric Circuit I	2	C	30	-
SUMAS EEE 313	Electromechanical Devices& Machine	3	C	45	-
SUMAS EEE 315	Laboratory course and Mini Project 1	1	C	-	45
	Total	17			

Second 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 and 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	E	30	-
SUMAS-CHE 312	Waste processing Technology	2	C	30	
SUMAS EEE 308	Laboratory courses and Mini Project 1I	1	E	-	45
	Total	22			

400 Level

First Semester

S/N	Course Code	Course Title	U	S	LH	PH
1	SUMAS-EEE 401	Control Engineering I	2	C	30	-
2	SUMAS-EEE 403	Digital Signal Processing	2	E	30	-
3	SUMAS-EEE 405	Electromagnetic Field and Wave II	3	C	45	
5	SUMAS-EEE 409	Power Electronics	2	C	15	
6	SUMAS-EEE 411	Communication Principles	2	C	30	
7	SUMAS-EEE 413	Electrical Power Principles	2	C	30	
8	SUMAS-EEE 415	Engineering System Modelling and Simulation	2	E	30	
		Total	15			

Second 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	6 weeks	-
GET 299	SIWESI: Students Industrial Work Experience Scheme	3	C	9 weeks	
GET 399	SIWES II: Students Industrial Work Experience Scheme	4	C	12 weeks	
GET 499	SIWES III: Students Industrial Work Experience Scheme	4	C	12 weeks	
	Total	15			

**500 Level
First Semester**

Course Code	Course Title	Units	Status	LH	PH
GET 501	Engineering Project Management	3	C	45	-
EEE 593	Final Year Project I	3	C		
SUMAS-EEE 503	Control Engineering II (Modern Control Engineering)	2	C	30	-
SUMAS-EEE 505	Digital Communications: Systems and Principles	2	C	30	-
Total		16			

Note: Students to choose three elective courses (6 credit units) from their desired options

Second Semester

Course Code	Course Title	UNITS	Status	LH	PH
GET 502	Engineering Law	2	C	30	
EEE 594	Final Year Project II	3	C		
SUMAS EEE 502	Reliability and Maintainability of EEE components and Systems	2	C	30	-
SUMAS EEE 504	Advanced Renewable and Hydrogen Cell Energy Systems	2	C	30	-

SUMAS EEE 506	Data communication and Networking in Electrical and Electronic Engineering	2	C	30	-
	Total	17			

Note: Students to choose three elective courses (6 credit units) from their desired options

First Semester

Communication System Option

Course Code	Course Title	U	S	LH	PH
SUMAS-EEE 507	Industrial Electronic Design	2	E	30	-
SUMAS-EEE 509	Solid State Electronics	2	E	30	-
SUMAS-EEE 511	Microprocessor and Embedded System Design for Electrical Engineers	2	E	30	-
SUMAS-EEE 513	Satellite and Microwave Communications	2	E	30	-

Electrical Power Option

Course Code	Course Title	U	S	LH	PH
SUMAS-EEE 521	Electrical Machine Design	2	E	30	-
SUMAS-EEE 523	Electrical Power System Engineering	2	E	30	-
SUMAS-EEE 525	Electrical Energy Utilization	2	E	30	-
SUMAS-EEE 527	Power Transmission and Distribution	2	E	30	-

Control Option

Course Code	Course Title	U	S	LH	PH
SUMAS-EEE 531	Artificial Neural Network & Programming	2	E	30	-
SUMAS-EEE 533	Robotics and Automatic system	2	E	30	-
SUMAS-EEE 535	Embedded System Design	2	E	30	-
SUMAS-EEE 537	Advanced Circuit Techniques	2	E	30	-

Second Semester

Communication System Option

Course Code	Course Title	UNITS	Status	LH	PH
SUMAS-EEE 508	Mobile and Wireless Communication	2	E	30	-
SUMAS-EEE 510	Antenna Theory and Propagation	2	E	30	-
SUMAS-EEE 512	Information Theory and Coding	2	E	30	-
SUMAS-EEE 514	Introduction to Robotic and Automation Engineering	2	E	30	-

Electrical Power Option

Course Code	Course Title	UNITS	Status	LH	PH
SUMAS-EEE 522	Advanced Electrical Machine and Drive	2	E	30	-
SUMAS-EEE 524	Power System Communication and Control	2	E	30	-
SUMAS-EEE 526	Computer Application in Power System	2	E	30	-
SUMAS-EEE 528	Power System Economics and Operations	2	E	30	-

Control Option

Course Code	Course Title	U	S	LH	PH
SUMAS-EEE 532	Numerical methods and Computer programming	2	E	30	-
SUMAS-EEE 534	Measurement and Instrumentation	2	E	30	-
SUMAS-EEE 536	Software Development Techniques	2	E	30	-
SUMAS-EEE 538	Advanced Microprocessor & Micro-controller System	2	E	30	-

Course Contents and Learning Outcomes

100 Level

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

Learning Outcomes

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

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

Course Contents

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

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

Learning Outcomes

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

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

Course Contents

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

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

Learning Outcomes

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

1. differentiate between science, engineering and technology, and relate them to innovation;
2. distinguish between the different cadres of engineering – engineers, technologists, technicians and craftsmen and their respective roles and competencies;
3. identify and distinguish between the relevant professional bodies in engineering;
4. categories 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.

SUMAS- COS 101: introduction to computer application (2unit:C, LH 15;)

Senate-Approved Relevance

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

Introductory computer application (ICA) course is to provide students at State University of Medical and Applied Sciences (SUMAS) with the foundation needed to proficiently use computers for personal and professional purposes. The course will introduce students to the basic functions of a computer, keyboard, mouse, and Internet. Students will also be introduced to software applications commonly used in business, including word processing, spreadsheet, presentation, and database software. Students will be encouraged to utilize online resources, such as Blackboard and Freedom, to augment classroom instruction. The skill and knowledge that will be acquired in ICA will launch SUMAS students up to an academic pedestal that will allow them to compete favorably with their peers anywhere in the world.

Overview

Introduction to Computer Application is a course that provides an overview of basic computer concepts and applications. It covers the essential knowledge and skills needed to use computer systems, software applications, and the Internet. The course typically includes instruction on basic computer hardware components, operating systems, word processing, spreadsheet software, and presentation software. Students will learn the basics of computer organization, such as input/output devices, memory, storage, and central processing units. They will learn how to create, save, and print documents using word processing software, create and format spreadsheets using spreadsheet software, and create presentations using presentation software.

The course also covers basic computer security and privacy concepts and introduces students to internet browsing and email usage. Additionally, students will learn about digital citizenship, online ethics, and responsible online behavior. Overall, an introductory computer application course provides students with a fundamental understanding of computer technology, its applications, and its impact on daily life. It is an essential foundation for individuals pursuing

further education or careers in fields such as business, education, engineering, science, or technology.

Objectives

The course is aimed at providing the following:

1. Recognize basic computer hardware and software: The first objective of an introductory computer application course is to help students understand the basic components of a computer system, such as the processor, memory, hard drive, and input/output devices, as well as common software applications, such as word processing, spreadsheets, and presentation software.
2. Identify basic computer skills: The course should aim to develop students' basic computer skills, such as using a mouse and keyboard, opening and closing applications, creating and saving files, and managing files and folders.
3. Illustrate the use common productivity software: The course should teach students how to use common productivity software applications, such as Microsoft Office or Google Suite, including word processing, spreadsheets, and presentation software.
3. Recognize the basics of computer networks: Students should learn about the basics of computer networks, such as how data is transmitted over a network, how to connect to a network, and how to troubleshoot basic network issues.
4. Identify basic programming skills: An introductory computer application course can also introduce students to programming concepts, such as basic programming syntax and logic, and provide hands-on experience with simple programming tasks.
5. Identify basic internet and web concepts: Students should also learn about basic internet and web concepts, including how to use a web browser, how to search for information on the internet, and how to create and manage an email account.
6. Identify information literacy: Finally, the course should aim to develop students' information literacy skills, such as how to evaluate the credibility and reliability of online sources, how to properly cite sources, and how to avoid plagiarism.

Learning Outcomes

On completion of this course, the student will be able to learn the followings:

1. Apply Basic computer skills: Students learn fundamental computer skills, including how to use the keyboard and mouse, navigate through the file system, create and save documents, and manage files and folders.
2. Operate Software applications: Introductory computer applications courses expose students to various software applications like word processors, spreadsheets, presentation tools, and database software.
3. Apply Internet skills: Students learn how to search for information online, how to browse the web safely, and how to use email and other forms of online communication.
4. Practice time management: Computer application courses teach students how to manage their time effectively by prioritizing tasks and setting achievable goals.
5. Demonstrate Analytical skills: Students learn how to analyze data and create reports using spreadsheets, graphs, and charts.
6. Demonstrate Communication skills: Computer application courses help students improve their communication skills by teaching them how to create professional-looking documents, presentations, and other forms of communication.
7. Apply Problem-solving skills: Through hands-on exercises and assignments, students develop problem-solving skills as they learn how to troubleshoot software applications and resolve technical issues.

Course Content

An introductory computer application course is designed to introduce students to fundamental computer skills and concepts, including the use of software applications, hardware components, and basic programming concepts. The following are some common topics covered in an introductory computer application course:

Introduction to computers and computing devices. Operating systems and file management. Word processing software and document formatting. Spread sheets and data analysis. Presentations and multimedia software. Web browsing and internet navigation. Email and communication software. Social media and online collaboration tools. Cloud computing and data storage. Computer security and data privacy. Basic programming concepts and logic. Algorithms

and problem-solving techniques. HTML and web development. Database management and querying. Basic networking and network protocols. Computer hardware components and peripherals. Emerging technologies and trends in computing. These topics may vary depending on the course and the instructor, but they provide a good overview of the basic concepts and skills covered in an introductory computer application course.

Minimum Academic Standard

As described in CCMAS.

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

Learning Outcomes

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

1. Have a good grasp of design thinking and be obsessed with the determination to apply such to solving simple every day and also complex problems;
2. Recognize the fundamental concepts of engineering drawing and graphics;
3. Show skills to represent the world of engineering objects in actionable solid models, and put such models in a form where they can be inputs for simulation and analyses;
4. Analyses such models for strength and cost.
5. Prepare the objects for modern production and manufacturing techniques of additive and subtractive manufacturing;
6. Recognize 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. Visualization 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. Viewport 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.

SUMAS- PHY 104: General physics IV: (Vibration, waves and Optics: (2 Units C: LH 15)

Senate-Approved Relevance

Graduates who are highly skilled in physics is in accord with the vision of SUMAS to become a leader in the discovery, dissemination, and application of new knowledge in areas of sciences for the development of self and society. Relevance is seen in graduates of Biomedical Engineering from SUMAS having sufficient science, engineering and programming knowledge that will enable the graduates to adapt to working in any engineering outfit, making graduates of the institution renowned and world-class.

Overview

The study of vibrations, waves, and optics is vital to the training of Biomedical Engineering graduates because their applications are used in solving Biomedical Engineering related problems. This highlights the importance of preparing students in Biomedical Engineering with the knowledge and skills on how to apply the basic concepts of vibrations, waves and optics in the solution of industrial problems. Therefore; this course will expose students on the basic concepts and analysis of vibration systems, wave energy, and optics.

Objectives

The objectives of the course are to:

1. describe and quantitatively analyze the behavior of vibrating systems and wave energy;
2. describe the propagation and properties of waves in sound and light;
3. identify and apply the wave equations;
4. describe geometrical optics and principles of optical instruments; and
5. describe Doppler effect

Learning Outcomes

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

1. describe and quantitatively analyze the behavior of vibrating systems and wave energy;

2. describe the propagation and state at least three (3) properties of waves in sound and light;
3. identify and apply the wave equations to solving three (3) problems;
4. describe at least two (2) geometrical optics and principles of optical instruments; and
5. describe Doppler effect.

Course Contents

Simple harmonic motion (SHM). Energy in a vibrating system. Damped SHM. Q values and power response curves. Forced SHM. Resonance and transients. Coupled SHM. Normal modes. Types and properties of waves as applied to sound. Transverse and Longitudinal waves. Superposition. Interference. Diffraction. Dispersion. Polarization. Waves at interfaces. Energy and power of waves. The 1-D wave equation. 2-D and 3-D wave equations. Wave energy and power. Phase and group velocities. Echo. Beats. The Doppler Effect. Propagation of sound in gases, solids and liquids and their properties. Nature and propagation of light. Reflection. Refraction, and internal reflection. Dispersion. Scattering of light. Reflection and refraction at plane. Spherical surfaces. Thin lenses and optical instruments. Wave nature of light. Huygens's principle. Interference and diffraction.

Minimum Academic Standards: As described in CCMAS.

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

Learning Outcomes

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

1. Define atom, molecules and chemical reactions;
2. Discuss the modern electronic theory of atoms;
3. Write electronic configurations of elements on the periodic table;
4. Rationalise the trends of atomic radii, ionization energies, electronegativity of the elements, based on their position in the periodic table;
5. Identify and balance oxidation–reduction equation and solve redox titration problems;
6. Draw shapes of simple molecules and hybridised orbitals;
7. Identify the characteristics of acids, bases and salts, and solve problems based on their quantitative relationship;

8. Apply the principles of equilibrium to aqueous systems using Le Chatelier's principle to predict the effect of concentration, pressure and temperature changes on equilibrium mixtures;
9. Analyse and perform calculations with the thermodynamic functions, enthalpy, entropy and free energy; and
10. Determine rates of reactions and its dependence on concentration, time and temperature.

Course Contents:

Atoms, molecules, elements and compounds, and chemical reactions. Modern electronic theory of atoms. Electronic configuration, periodicity and building up of the periodic table.

Hybridization and shapes of simple molecules. Valence forces; Structure of solids. Chemical equations and stoichiometry; chemical bonding and intermolecular forces, kinetic theory of matter. Elementary thermochemistry; rates of reaction, equilibrium and thermodynamics. Acids, bases and salts. Properties of gases. Redox reactions and introduction to electrochemistry. Radioactivity.

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

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

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

Course Contents

Laboratory experiments designed to reflect topics presented in courses CHM 101 and CHM102. These include acid-base titrations, qualitative analysis, redox reactions, gravimetric analysis, data analysis and presentation.

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;
2. Solve quadratic equations;
3. Solve trigonometric functions;
4. Identify various types of numbers; and
5. Solve some problems using binomial theorem.

Course Contents

Elementary set theory, subsets, union, intersection, complements, Venn diagrams. Real numbers, integers, rational and irrational numbers. Mathematical induction, real sequences and series, theory of quadratic equations, binomial theorem, complex numbers, algebra of complex numbers, the argand diagram. De-Moiré's theorem, n th 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. Recognize and understand the meaning of function of a real variable, graphs, limits and continuity;
3. Solve some applications of definite integrals in areas and volumes;
4. Solve function of a real variable, plot relevant graphs, identify limits and idea of continuity;
5. Identify the derivative as limit of rate of change;
6. Identify techniques of differentiation and perform extreme curve sketching;
7. Identify integration as an inverse of differentiation;
8. Identify methods of integration and definite integrals; and
9. Perform integration application to areas, volumes.

Course Contents

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

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; Bernoulli's equation and incompressible fluid flow; surface tension; adhesion, cohesion, viscosity, capillarity, drops and bubbles.

SUMAS- GET 109: Environmental and awareness and protection

(2 Units C: LH 30)

Senate – Approved Relevance

The world class training of students who are highly knowledgeable in a wide range of environmental challenges and opportunities in Enugu State and are adequately exposed to environmental management systems, legal framework and socio-cultural issues pertaining to utilization of natural resources are in tandem with SUMAS' mission statement of "protection of future generation and improving the quality of life". Graduates from SUMAS are therefore expected not only to become environmental protection ambassadors in their various areas of profession but to be highly aware of issues concerning our environment with relevance to sustainable economic development.

Overview

Environmental awareness and protection are cardinal in every economy for the achievement of Sustainable Development Goals (SDGs). This involves proper management of the micro and macro environment. Proponents of environmental management therefore call for a systems approach where every profession must contribute positively towards the protection of the

environment. This is in accordance with Agenda 21's slogan of "Think globally, while acting locally". The purpose of this course is therefore to ensure that graduates of SUMAS are in tune with world best practices of environmental protection and acquire skills in environmental surveillance, monitoring, planning and management for the wellbeing of the present and future generations.

Objectives

The objectives of the course are to:

1. define the term "Our Environment"
2. illustrate the various environmental systems
3. provide a comprehensive description of urban environmental problems and their solutions
4. identify rural environmental problems and their solutions
5. determine the legal framework for environmental protection in Nigeria
6. describe the meaning of sustainable development and sustainable development goals (SDGs)
7. present the interplay between population, poverty and environment
8. examine the concepts of renewable and non-renewable resources
9. describe pollution and its various control measures
10. explore issues and challenges of waste management including generation, collection, transportation and disposal
11. show the relationship between resource depletion and environmental protection
12. describe environmental protection regulations and standards
13. explain the concept of climate change
14. explain environmental degradation

Learning Outcomes

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

1. give at least four definitions of the term "our environment";
2. illustrate the various environmental systems;
3. provide at least five urban environmental problems and their solutions;
4. identify at least five rural environmental problems and their solutions;
5. discuss the legal framework for environmental protection in Nigeria;
6. describe the meaning of sustainable development and sustainable development goals (SDGs);

7. illustrate the interplay between population, poverty and environment;
8. examine the concept of renewable and non-renewable resources;
9. describe the 3 types of pollution and their various control measures;
10. explore issues and challenges of waste management system including generation, collection, transportation and disposal;
11. show the relationship between resource depletion and environmental protection;
12. describe environmental protection regulation and standards by NESREA;
13. discuss with examples the concept of climate change;
14. explain environmental degradation.

Course Content

Definition and meaning of environment. Environmental education. Man and environment. Environmental systems (e.g. ecosystem). Urban environmental problems and mitigating measures. Rural environmental problems and mitigating measures. Renewable and non-renewable resources. Sustainable development and SDGs. Legal framework for environmental protection in Nigeria. Population, poverty and the environment. Environmental toxicology. Pollution control. Waste Management. Resource depletion and environmental protection. Climate change. Environmental protection and regulation standards. Land use planning. Landscaping and environmental design. Environmental degradation.

Minimum Academic Standards: As described in CCMAS.

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 specialization and work environment. Skill requirements (soft and hard). Qualities for Engineers. Careers related to EEE. Typical course modules. Job outlook/opportunities for 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

SUMAS GET 106: APPLIED MECHANICS (2units; c; LH; 30)

Senate-Approved Relevance

Training engineers with sound knowledge of mechanics which is the building block of statics, dynamics, and strength of materials is fundamental to the vision of the State University of Medical and Applied Sciences (SUMAS) to produce graduates who are knowledgeable, creative, and innovative. Sustainable development goal aims to develop quality reliable, sustainable, and resilient infrastructure, hence graduates with good knowledge and technical application of applied mechanics, as bridge between theory and practical application to technology would go a long way in the development of sustainable material for sustainable industrialization.

Overview

Applied mechanics investigates the motion of solid materials observed by humans without the assistance of instruments. It is classified into statics and dynamics. While statics deals with forces that acts on a body at rest, dynamics deals with body in motion which is further subdivided into kinetics and kinematics. Different materials react differently when a load is applied, and this provides a very useful information in materials selection and the expected service life of such materials.

This course fortifies the learners with the classical mechanics such as force, mass, and motion and moreover problem-solving skills via the application of principles of mechanics to basic engineering problems. It also encompasses the concepts of thermoplastic, elasticity theory, fracture mechanics, fracture and failure mechanism, fatigue, and computational mechanics. Furthermore, material response and performance are important design consideration for engineers especially mechanical, structural, and civil engineers.

Objectives of the Course

The objectives of the course are to:

- 1) Explain the theory, concepts, principles, and equations that govern the motion of solid materials;
- 2) Describe the broad categories of applied mechanics;
- 3) Develop the capacity to visual and create meaningful mathematical model of a body subjected to force within the context of engineering application;
- 4) Differentiate between kinetics and kinematics and explain the concepts of acceleration, velocity, and the response of body due to applied external loads such as force and torque;
- 5) Use interpersonal understanding, teamwork and communication skills working on group assignments;
- 6) Apply several mechanics formulas derived to solve example problems;
- 7) Explain shear forces and bending moments diagrams; and
- 8) Explain deflection of beams.

Learning Outcomes

It is expected that at the end of this practical course, the students will be able to:

- 1) Define basic concepts in applied mechanics and formulate kinetic and kinematic formula that govern rigid bodies;
- 2) List and explain the two broad categories of applied mechanics as well their sub-classifications;
- 3) Identify the actual restraints and equations that govern a given engineering structure within a specified condition;
- 4) Identify kinematic and kinetic problems and analyse several loading conditions;
- 5) Show competence in understanding and teamwork in the given group assignments;
- 6) Solve several example problems by applying the principles learnt in the course;
- 7) Draw Shear forces and bending moments diagrams; and
- 8) Determine deflection of beams.

Course Contents

Forces, Moments, Couples Equilibrium of simple structures and machine parts. Friction First and second moments of area. Centroids, Kinematics of particles in plane motion, Kinematics of rigid bodies in plane motion. Free body diagram. Newton's laws of motion, Kinetic energy and

momentum analyses. Hooke's law. Stresses and strain due to loading and temperature changes. Shear forces. Work, Power, Energy Torsion. Stress circle. Deflection of beams with symmetrical. Deflection of beams with combined loadings. Resultant of coplanar forces. Elastic buckling of columns. Shear forces and bending moments. Bending moment diagrams. Analytical methods for structures.

Minimum Academic Standards: As described in CCMAS.

SUMAS-GET 108: Occupational Safety [2 Units, C: LH 30]

Senate-approved relevance

Training of high-quality graduates that are well knowledgeable to work in a protective environment as well as the health and safety of workers in engineering operations in Nigeria in line with SUMAS' mission to address African developmental challenges by producing graduates in Electrical and Electronic engineering.

Overview

Environmental and Occupational Safety (EOS) provides a general introduction to the field of occupational safety and health in any kind of working environment. The course includes introducing concepts, terminology, and methodology in the practice of EOS and identifying resource materials.

Objectives

The objectives of the course are to:

1. Provide information of some of the important international conventions which will be useful during the future endeavours after graduation
2. Be informed of the relevant legislations and of any new regulation concerning the EOS.
3. Health hazards at work and exposure assessment standards
4. Evaluating the working environment (surveys, sampling, risk assessment)
5. Controlling health hazards Selection and Use of Personal Protective Equipment
6. Make realize the importance of natural resources management for the sustenance of the life and the society.
7. Apprise the impact of pollution getting generated through the anthropogenic activities on the environment

8. Provide the concept of Sustainable Development, energy and environmental management
9. Impart knowledge on the new generation waste like e-waste and plastic waste

Learning outcomes

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

1. Recognize, evaluate and recommend controls for a variety of potentially hazardous occupational exposures.
2. Mention basic legislations, regulations and guidelines in EOS
3. Conduct a complete survey in a working environment and identify the potential hazards and stresses for the health of the workers.
4. Propose preventive or mitigation strategies to sustain or improve the health of the workers.
5. List safety precautions that must be observed in an engineering environment
6. Mention some of the importance of natural resources management for the sustenance of the life and the society.
7. Show familiarity on various forms of pollution and its impact on the environment.
8. Describe the elements of Sustainable Development, energy and environmental management
9. Acknowledge on the role of new generation waste like e-waste and plastic waste

Course contents

General principles of evaluating the work environment include sampling methodology, evaluating exposure to health hazards and controlling them, the principles of ventilation, personal protective equipment, and safety signs. hazards at work (exposure to harmful physical, chemical, and biological agents), such as chemicals, noise, and thermal stress. ergonomics and psychological stress are also discussed. a special focus is given to the regulations for chemicals and the management of safety and health at work. risk assessment, prevention, and mitigation strategies. environmental impact assessment and environmental audit in metallurgical and materials engineering. impact of mining on the environment and possible environmental management options in mining and processing of the minerals, sustainable resource management

(land, water, and energy), and resilient design under the changing environment, management of plastic waste and e-waste: sources, generation and characteristics of various e- and plastic wastes generated from various industrial and commercial activities; waste management practices including onsite handling, storage, collection and transfer. e-waste and plastic waste, processing alternatives, e-waste management rules and plastic waste management rules, 2016 and their subsequent amendments

Minimum Academic Standards: As described in CCMAS.

200 Level

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

Learning Outcomes

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

1. Know the basic features of philosophy as an academic discipline;
2. Identify the main branches of philosophy & the centrality of logic in philosophical discourse;
3. Know the elementary rules of reasoning;
4. Distinguish between valid and invalid arguments;
5. Think critically and assess arguments in texts, conversations and day-to-day discussions;
6. Critically assess 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.

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

Course 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.

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;
5. Explain the basic A.C. circuit theory and
6. 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 202: Engineering Materials (3 Units C: LH 45)

Learning Outcomes

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

1. Demonstrate the role of atoms and molecules (aggregates of atoms) in the building of solid/condensed matter known as engineering materials, the electron quantum numbers and how the electrons are arranged in different atomic elements, and explain the role of electronic configuration and valence electrons in bonding;
2. Define metals, alloys and metalloids, demonstrate mental picture of the solid mineral resources development as a relay race among four 'athletes': geologist, mining engineer, mineral processing technologist, process metallurgical engineer, and classify metallurgical engineering into 3Ps: process, physical and production;
3. Explain the relationship between structure and properties of materials, characteristics, components and compositions of phase diagrams and phase transformations of solid solutions;
4. Define ceramics, glass and constituents of glasses and understand application of ceramics in mining, building, art and craft industries;
5. Define and classify polymers as a class of engineering materials and polymeric materials, demonstrate polymerisation reactions, their types and mechanism, and applications of polymers;
6. Define properties, types and application of composite materials and fibres (synthetic and natural);
7. Define and classify nanomaterials, demonstrate applications of nanomaterials, concept, design and classification of fracture mechanics, corrosion classification, including the five principal

ways of controlling corrosion and metal finishing processes such as sherardising, galvanising and anodising; and

8. Identify factors affecting the performance and service life of engineering materials/metals and metallography of metals/materials (materials anatomy), which enables Electrical and Electronic engineers to prescribe appropriate solutions to test metals/materials fitness in service through structure-property-application relationships.

Course Contents

The material science; atomic structure, atomic bonding and crystal structures. Engineering materials situating metals and alloys; metals and alloys, classifications of metals, metal Engineering and Technology 280 new extraction processes using iron and steel (ferrous) and aluminium (nonferrous) as examples, phase diagrams/iron carbon diagrams, and mechanical workings of metals. Selection and applications of metals and alloys for specific applications in oil, aerospace, construction, manufacturing and transportation industries, among others. Ceramics (including glass); definition, properties, structure and classifications of ceramics. Bioactive and glass – ceramics. Toughening mechanism for ceramics. Polymers: definition of polymers as engineering materials; chemistry of polymeric materials, polymer crystallisation, polymer degradation and aging. Thermoplastic and thermosetting polymers and concepts of copolymers and homopolymers. Composites; definition, classification, characterisation, properties and composite. Applications of composites. Nanomaterials; definition, classification and applications of nanomaterials as emerging technology. Processing of nanomaterials including mechanical grinding, wet chemical synthesis, gas phase synthesis, sputtered plasma processing, microwave plasma processing and laser ablation. Integrity assessment of engineering materials; effect of engineering design, engineering materials processing, selection, manufacturing and assembling on the performance and service life of engineering materials. Metallography and fractography of materials. Mechanical testing (destructive testing) of materials such as compressive test, tensile test, hardness test, impact test, endurance limit and fatigue test. Non-destructive test (NDT) such as dye penetrant, x-ray and eddy current.

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

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 devices and instruments, and acquire skills in their effective use and maintenance;
2. Practically apply basic engineering technologies, including metrology, casting, metal forming and joining, materials removal, machine tooling (classification, cutting tool action, cutting forces, non-cutting production) and CNC machining technology;
3. Master workshop and industrial safety practices, accident prevention and ergonomics;

4. Physically recognize different electrical & electronic components like resistances, inductances, capacitances, diodes, transistors and their ratings;
5. Connect electric circuits, understand different wiring schemes, and check ratings of common household electrical appliances and their basic maintenance; and
6. Determine household and industrial energy consumption and understand practical energy conservation measures.

Course Contents

The course comprises general, mechanical and electrical components: supervised hands-on experience in safe usage of tools and machines for selected tasks; Use of measuring instruments (calipers, micrometers, gauges, sine bar, wood planners, saws, sanders, and pattern making). Machine shop: lathe work shaping, milling, grinding, reaming, metal spinning. Hand tools, gas and arc welding, cutting, brazing and soldering. Foundry practice. Industrial safety and accident prevention, ergonomics, metrology. Casting processes. Metal forming processes: hot-working and cold-working processes (forging, press tool work, spinning, etc.). Metal joining processes(welding, brazing and soldering). Heat treatment. Material removal processes. machine tools and classification. Simple theory of metal cutting. Tool action and cutting forces. Introduction to CNC machines. Supervised identification, use and care of various electrical and electronic components such as resistors, inductors, capacitors, diodes and transistors. Exposure to different electric circuits, wiring schemes, analogue and digital electrical and electronic measurements. Household and industrial energy consumption measurements. Practical energy conservation principles.

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

Learning Outcomes

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

1. Explain the properties of fluids;
2. Determine forces in static fluids and fluids in motion;
3. Determine whether a floating body will be stable;
4. Determine the effect of various 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; arrange the ideal and real gas equations of state,
5. Formulate the first law of thermodynamics for a closed system i.e. organize the change in energy in the closed systems via heat and work transfer;
6. Distinguish heat transfer by conduction, convection and radiation, and calculate the amount of heat energy transferred;
7. Calculate the changes in moving boundary work, spring work, electrical work and shaft work in closed systems;
8. Apply the first law of thermodynamics for closed systems and construct conservation of mass and energy equations;
9. Formulate the first law of thermodynamics to the open systems i.e. describe steady-flow open system, apply the first law of thermodynamics to the nozzles, diffusers, turbines, compressors, throttling valves, mixing chambers, heat exchangers, pipe and duct flow;
10. Construct energy and mass balance for unsteady-flow processes;
11. Evaluate thermodynamic applications using second law of thermodynamics;
12. Calculate thermal efficiency and coefficient of performance for heat engine, refrigerators and heat pumps; and

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

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

Learning Outcomes

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

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

Course Contents

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

SUMAS-MEE 243: Measurement and Instrumentation [3 Units, C: LH 30]

Senate-approved Relevance

Training potential mechatronic engineers in Measurement and Instrumentation as it applies in the multidisciplinary field involving a synergy between mechanical, electronic and computer software engineering. This will develop engineers with adequate knowledge, skill and ability to apply the principles of process measurement, instrumentation and process control. This is in accordance with Sumas' mission to improve the quality of life for all. Through mechatronics philosophy and design thinking in developing products, processes and in the delivery of services.

Overview

The general principles of measurement and instrumentation deals with Error analysis, sensors, signal conditioning and data presentation elements, and power supplies. The role of the various elements of a measurement system is to evaluate the given inputs signals to determine the corresponding output. The course will apply common sensors and signal components to

determine various instrumentation real system. Real-world case studies such as acoustic emission detection, vibration monitoring, triboelectric sensing, flow measurement and structural health monitoring are provided to illustrate the applications and significance of measurement systems in industry.

Objectives

The objectives of the course are to:

1. understand the basic working principles of electrical and electronic measuring instruments.
2. receive the skills to managing and operating analogue and digital instruments for a particular application.
3. learn the ways of presenting and interpreting results.
4. calculate the uncertainty of the direct and indirect single and multiple measurements.

Learning Outcomes

After successful completion of the course, the student will be able to:

1. Analyse the performance characteristics of each instrument;
2. Analyse basic metres such as voltmeters and ammeters;
3. Explain different types of signal analysers;
4. Explain the basic features of oscilloscope and different types of oscilloscopes;
5. Apply the complete knowledge of various electronics instruments/transducers to measure the physical quantities in the field of science, engineering and technology.

Course Contents

Errors in measurements, classification and functional analysis, performance of instruments systems, calibration. Control system components, amplifiers, sensing devices, pumps and controllers, error detectors and output elements, instrumentation methods; measurements and recording of dimensions, time, weight, frequency, temperature, pressure, transducers, bridge and potentiometer methods. Synchros, Hall effects, photovoltaic and moving iron transducers. Instrument transformers, Pulse transformers, energy meters and metering, information storage

techniques, electronic instrumentation, digital technique, analog/digital signal processing. Survey of modern instrumentation components. Non-linear computing elements.

Minimum Academic Standard: As described in CCMAS

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

Learning Outcomes

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

1. Describe and apply computing, software engineering knowledge, best practices, and standards appropriate for complex engineering software systems;

2. Develop competence in designing, evaluating, and adapting software processes and software development tools to meet the needs of an advanced development 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. Recognize human, security, social, and entrepreneurial issues and responsibilities relevant to engineering software and the digitalization of services; and
6. Acquire capabilities that can further be developed to make them productively employable by means of short Internet courses in specific areas.

Course Contents

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

SUMAS- GET 214: Engineering Economics (2 Units C: LH 30)

Senate-Approved Relevance

The need for engineering economy is primarily motivated by the fact that everything in engineering must be done economically and optimally, whether it is designing an equipment, selecting between alternatives, operating a plant, marketing a product, or maintaining a plant, all of which involve a decision-making process. The fundamental elements of cash flows of money, time, and interest rates are all involved in the decision-making process. This course introduces the fundamental concepts and terminology required for an engineer to combine these three key elements in order to solve problems and make better decisions. Because engineering economics formulas and techniques are applicable to all types of money matters, they are equally useful in business and for individuals.

Overview

The course deals with the decision of where and how to invest the limited resources motivated by a primary goal of adding value as future, anticipated results of the selected alternative. It involves formulating, estimating, and evaluating the expected economic outcomes of alternatives designed to accomplish a defined purpose, normally an engineering project at the best values of decision metrics. Mathematical techniques simplify the economic evaluation of alternatives.

Course Objective

The main objectives of the course are to:

1. Equip students with grounded skill of economic decision making in engineering considerations.
2. Take students through a taxonomy of engineering costs and valuation.
3. Educate students on the principle of time value of money and cash flows.
4. Introduce the economic methods for evaluating capital projects and mainstream cash flow analysis.
5. Acquaint students with the understanding of Sensitivity and Breakeven analysis.
6. Introduce the required elements of Accounting in Engineering.

Learning Outcome

At the end of the Course, Students will be able to:

1. Take economic and optimal cost decisions in Engineering.
2. Compute fixed and variable costs, recurrent and non-recurrent costs, life-cycle costs, as well as cost estimation models.
3. Compute cash flows; time value of money; simple interest, compound interest, interest formulas, economic analysis with spreadsheets.
4. Undertake economic Sensitivity and Breakeven analysis, compare alternatives and decision analysis as well as uncertainty (Risk) analysis.
5. Monitor and understand Inflation and price change, minimum attractive rate of return and other metrics of engineering economic analysis.

Course Contents

Economic decision making in Engineering. Engineering costs and cost estimation: fixed and variable costs, recurrent and non-recurrent costs, life-cycle costs, etc; cost estimation models;

estimating benefits; cash flow diagrams. Interest and Equivalence: Computing cash flows; time value of money; simple interest, compound interest, interest formulas, economic analysis with spreadsheets. Economic Methods for evaluating capital projects: Present worth analysis; Annual cash flow analysis; Rate of return analysis; Future worth analysis; Benefit-Cost ratio analysis; Payback period; Sensitivity and Breakeven analysis. Comparison of alternatives and decision analysis. Uncertainty (Risk) analysis. Taxes, tariffs and duties. Depreciation and Replacement analysis. Inflation and price change. Minimum attractive rate of return (MARR). Public Sector economic analysis. Elements of Accounting for Engineering Economy.

Minimum Academic Standard: As described in CCMAS

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, interpersonal skills and technical capabilities needed to give them a sound engineering foundation;
2. Learn and practice basic engineering techniques and processes applicable to their specializations;
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

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 organizations, media and traditional institutions in peacebuilding.

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, Zango Kartaf, 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, e.t.c). 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, unutilized 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.

SUMAS- CHE 312: Waste processing technology (2 Unit C: LH 15)

Learning Outcomes

Senate Approval Relevance:

This comes in recognition of the relevance to the vision and mission of the SUMAS' strategic plan to turn out Biomedical Engineers who are adequately skillful to innovate on the waste

processing techniques and waste management strategies in our immediate and remote environments, and industrial or municipalities in a fast-transforming world of circular economy. Training chemical engineering students in waste processing technology is giving them knowledge and skill for self-reliance and in part preparing them for entrepreneurship and lead private and industrial consultancies in the area. This is in line with SUMAS' vision of developing quality manpower using technology to serve society which is in tandem with the global practice of offering functional education. Moreover, SUMAS or the Department of Mechanical Engineering could commercialize or patent innovative processes arising from the teaching of this course.

Overview

This course emphasizes processes based on anaerobic digestion of organic materials/matter in which microorganisms break down biodegradable materials in the absence of oxygen. These processes apply widely; treating wastewater sludge and organic wastes for the fact that it provides volume and mass reduction of input material. This course provides SUMAS Mechanical Engineering graduates with basic understanding about conventional and natural waste water treatment technologies as well as integrated solid waste management. Knowledge about wastewater management can be used to solve the issue of environmental waste problem.

Plasma pyrolysis or plasma gasification, for example, is a waste treatment technology that gasifies matter in an oxygen-starved environment to decompose waste material into its basic molecular structure. The process demands high electrical energy for creating high temperature by an electrical arc gasified.

Objectives

The objectives of the course are to:

1. identify sources of water pollution, priority pollutants and their impacts on water bodies as well as processes of purification and instrumentation.
2. explain protection of environment from pollution and contamination and repair and reduce the damage caused by pollution.
3. describe key biological treatment procedures such as activated sludge and biofilm, N and P removal sludge system, natural and on-site treatment systems
4. capture the waste management hierarchy and the principles of integrated waste management, the impact of wastes on health, environment and the enforcing legislation

5. recognize types of wastes, the compositions, properties and amount of waste, the collection and transportation of the wastes, optimization techniques, recycling stations and transfer stations
6. clarify mechanical processing of wastes, incineration and biological treatment procedures
7. conveniently institute sanitary landfilling process, understand the risks, hazards and nuisances as well as mitigation steps therein including bottom lies and cover materials, collection and treatment of leachate and gas

Learning Outcomes

At the end of the teaching encounter with the students, students should be able to

1. apply the skill of increasing recycling, reducing carbon emissions, and attaining sustainability goals. improve air and water quality as well as reduces greenhouse gas emissions;
2. employ data-driven waste solutions for garbage collection in smart cities;
3. describe simple waste solutions-No litter and less costs;
4. evaluate the subject from the technical, legal and economical points by learning of all terms related to general solid waste management;
5. state the hierarchical structure in solid waste management and a requirement for an integrated solution;
6. examine the technical points that are required to set up a solid waste management system;
7. Apply the legal legislation related to solid waste management;
8. Evaluate economic analysis of the solid waste management system;
9. Make route optimization for a solid waste collection and transport system;
10. Plan a recycling program;
11. Design a packaging waste separation facility;
12. Design an incineration facility;
13. Make site selection for a landfill;
14. Plan a solid waste management system for decision makers.

Course Content

Sources for water pollution. Priority, pollutants and their effect on water bodies. Eutrophication and self-purification processes. Characteristics and composition of waste water. Pollution load, sewage pumps and pumping stations. Primary purification devices, mechanical treatment. Screening, sand trap, sedimentation. Biological treatment Activated sludge and biofilm, N and P removal sludge treatment. Natural treatment systems and on-site treatment systems. Waste management hierarchy and principles of integrated waste management. Impact of wastes on health and environment, legislation. Types of wastes, compositions, properties, and amount of waste. Collection and transportation of wastes. Optimization. Recycling stations, transfer stations. Mechanical processing of wastes. Incineration and biological treatment. landfilling, risks, hazards, and nuisances. and their mitigation methods. Bottom lines and cover materials. Collection and treatment of leachate and gas.

Minimum Academic Standard: As described in CCMAS

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 transformation.

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

Learning Outcomes

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

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

Course Contents

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

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

Learning Outcomes

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

1. Demonstrate the concept of clear writing, common pitfalls and unambiguous language in engineering communication, including technical reporting for different applications and emotional comportment;

2. Demonstrate the skills of language flexibility, formatting, logic, data presentation styles, referencing, use of available aids, intellectual property rights, their protection, and problems in engineering communication and presentation; and
3. Demonstrate good interpersonal communication skills through hands-on and constant practice on real-life communication issues for engineers in different sociocultural milieu for engineering designs, structural failure scenarios and presentation of reports.

Course Contents

A brief review of common pitfalls in writing. Principles of clear writing (punctuations and capitalization). Figures of speech. Units of grammar. Tenses and verb agreement. Active and passive sentences Lexis, structure Fog and Index concept. Skills for communication and communication algorithm. Types and goals of communication; Interpersonal communication; features and the Finger Model or A,B,C,D,E of good interpersonal communication (accuracy of technical terms, brevity of expression, clarity of purpose, directness of focus and effectiveness of the report). Language and organization 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, organization, use of visual aids and practicing 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, Mathematical or MATLAB, and Design Expert to summarize, 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. Recognize and analyse the current energy systems in Nigeria, their impacts on development and the global energy demand and supply scenarios;
4. Appreciate the environmental impact of energy exploitation and utilization, and pursue the sustainable development of renewable energy for various applications; and
5. Recognize 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; emphasize 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.

SUMAS EEE 313: Electromechanical Devices & Machine (3 Units; Core; LH= 45; PH=0)

Senate Approval Relevance

Electromechanical Devices and Machines deals with the relationship between electromagnetic science of electrical engineering and mechanics. The application of the course can be found in most household appliances, automobile industries, audio and video players/recorders, printers, and pneumatic control systems. Almost every device or machine with electrical and mechanical processes are generally considered as electromechanical. They are usually found in everything from industrial machines to consumer products. In line with the Madonna university mission and vision, the knowledge of the course will equip the students with skills and ethical orientation necessary for excellence as engineers in the industry, academia and public service.

Overview

The courses covers the theory of electromagnetic field and mechanical energy conversion principles in electrical machines. The principles of operation of electrical machines and their characteristics such as alignment, force, torque, excitation, and basic concept of flux linkages with are generally considered. General principle of operation of transformer, and its classification, equivalent circuit, phasor diagram and the performance calculations are treated under the course. In addition to the laboratory class, vigorous teaching and demonstration of these principles in machines and transformer theory will be exposed to the students in the area of winding techniques and effect of electric current in the windings.

Objectives

The Objectives of the Course are to;

1. Explain magnetic circuit and it electromechanical conversion principles.
2. Describe laws associated with magnetic field and its applications in machines.
3. Explain the general features of transformer, classifications and its operation.
4. Explain the use of phasor diagrams and equivalents circuit in transformer analyses.
5. Identify the difference in voltage and current transformers and its vector groupings
6. Explain the winding theory in transformers.

Learning Outcomes

On completion of the course, students are expected to;

1. Understand the magnetic circuits and magnetic field energy conversion principles.
2. Analyze laws Lenz, Faraday and Fleming rules and others in magnetic theory.
3. Identify basic elements in electrical machines and concept of magnetic flux linkages.
4. Understand features of transformer and its classification according to voltage levels.
5. Analyze phasor diagrams and equivalent circuits of transformer.
6. Know the use of voltage and current transformers and their vector groupings.
- 7.

Course Contents

Magnetic field energy. Electromechanical energy conversion principles. Alignment force and torque. Single excitation. Interaction forms and force. Prototype two-pole cylindrical machine. Multi-polar machines. Elementary linear machines. Basic elements of an electrical machine. Basic concepts of flux linkage and linkage change. General features and principle of operation of transformer. Transformer classification. Equivalent circuits and phasor diagrams. Determination

of transformer parameters and performance calculations. Voltage regulation. Efficiency. Parallel operation. Load sharing. Auto and audio transformers. Potential and current transformer. Vector grouping and connections. Harmonics and noise. Tap-changing transformer. Three-winding transformers and rating.

SUMAS EEE 315: Laboratory Courses and Mini Project I (1 Unit C: PH 45)

Senate-Approved Relevance

The course is designed to train graduate to be highly skilled and knowledgeable in the principles and operation of electrical machines and communication engineering, and to apply the knowledge acquired in solving technological problems arising from the need of society, immediate community and nation at large. Adequate exposure of students to practical aspect of theories will deepen their understanding which will make real life challenges more approachable technologically. This is in tandem with SUMAS mission and vision in producing graduates who are creative, self-reliance and technologically problem solving oriented.

Overview

This course is structured to expose students to practical aspect of all the EEE courses in the semester. The course is sectioned into two parts. One part is the laboratory practical for principle of electrical machines: DC motors and generators. While part two is for all other EEE courses. The students will be assigned a mini project that implement the application of circuit design and construction of a simple project.

Objectives

The objectives of this course are to

1. measure the speed of motor using a D. C tachogenerator;
2. determine synchronous machine winding resistance;
3. understand phase control of a D.C series motor;
4. measure shunt dc machine winding resistance;
5. study the operation of the elementary modulator
6. study the operation of the diode DSB (Double Side Band) modulator;
7. analysis the characteristic of the half-wave demodulator; and
8. study the significant improvement that a full-wave demodulation has over envelope demodulator.

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;
6. prepare and present practical reports and
7. design and construct mini project.

Course Contents

The experiments in this course are designed to educate the students in the laboratory/practical aspects of the lecture courses of EEE courses in the semester. Thus, students will be required to investigate the characteristics and uses of vacuum devices and semiconductor devices including diodes, bipolar junction transistors and field effect transistors (FET)

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 software 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 troubleshooting, and wooden furniture making processes.

Section B: Mechanical design with computer graphics and CAD modelling and drafting. Introduction to Solid works: software capabilities, design methodologies and applications. Basics part modelling: sketching with SolidWorks, building 3D components, using extruded Base · Basic assembly modelling, and solid Works drawing drafting. Top-down assembly technique exploded view, exploded line sketch. Introduction to PDMS 3D design software; AutoCAD mechanical, SPSS. A comprehensive case study design project. The student should be introduced to the concept of product/component design and innovation and then be given a comprehensive design project.

Examples of projects should include the following:

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

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.

Course contents

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

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

Course Contents

Non-linear circuit analysis. Network functions, Locus diagrams. Circuit synthesis: realizability 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.

SUMAS EEE 308: Laboratory Courses and Mini Project II

(1 Unit C: PH 45)

Senate approved relevance

The training of high-quality graduates who are highly skilled in the design and operation of *electronic devices modern*, evaluation, diagnosing and repairs abilities in various ways that can contribute to the development of a more satisfying life and environment for the benefit of mankind, in Nigeria and the world at large is of great importance to SUMAS. This is necessary

to produce a role model, self-reliant and excellent electrical engineers with adequate technical skills, fundamental concepts relevant to latest development, entrepreneurial competences, practical skills in the field of process control, communications, computers, power and signal sources, displays and measuring systems and management skills to handle national and international issues in electrical and engineering.

Course Overview

This course covers experiments on identification and study of the input-output characteristics of PN diodes. Identification and operation of bipolar junction transistors and field effect transistors. Experiments will also focus on the design, construction and performance evaluation of various types of electronic amplifiers, electromechanical energy conversion devices and machines.

Objectives:

The objectives of the course are to:

1. study the characteristics of forward and reverse characteristics of pn junction diodes;
2. study the characteristics of transistor including the different regions of operation;
3. determine and graph the input output characteristics of bipolar junction transistor
4. measure the h-parameter of a bipolar junction transistor at a given dc bias point
5. construct the transistor circuit;
6. investigate the field effect transistor (FET) characteristics;
7. study the output or drain and transfer characteristic of field effect transistor;
8. design, construction and operation of electronic amplifier; and.
9. design and construct mini project.

Learning Outcome

On completion, the student should be able to:

1. identify the different characteristics of semiconductor diodes;
2. learn the diode polarity and understand the proper bias;
3. understand voltage and current characteristics of diode including its operation;
4. identify the three terminals or regions and types of bipolar junction transistors;
5. design an electronic amplifier; and
6. design and construct mini project.

Course Content

The experiments in this course are designed to educate the students in the laboratory/practical aspects of the lecture courses all the EEE courses in the semester. Thus, students will be required

to investigate the characteristics and uses of vacuum devices and semiconductor devices including diodes, bipolar junction transistors and field effect transistors (FET).

400 Level

SUMAS EEE 401: Control Engineering I

(2 Units E: LH 30)

Senate Approved Relevance

The goal of State University of Medical and Applied Sciences (SUMAS), Igbo-Eno, Enugu State is to produce highly qualified electrical and electronic engineering graduates, therefore training graduates who are highly talented and knowledgeable in the analysis and design of control systems as well as the application of control theory to solve engineering problems makes sense. This course will give the students the necessary understanding of control system design and analysis methodologies, as well as how to apply such techniques to meet desired system performance specifications. Graduates who have received the proper training will be able to analyze, create, and optimize complex systems in order to increase the performance of the system as a whole.

Overview

The fundamental ideas, tenets, and advantages of the traditional feedback control system are covered in this course. It provides a succinct overview of control system components and categorizes control systems based on signal types. There is a brief discussion of useful Laplace theorems as well as Laplace transforms of frequently encountered time functions. It encompasses the use of physical laws like Newton's laws and Kirchhoff's law to create models for mechanical, electrical, and electromechanical physical systems using differential equations, transfer functions, signal flow graphs, and state spaces. Additionally presented are Routh's stability criteria and transient and steady-state analyses of dynamic systems to impulse, step, ramp, and parabolic functions. The use of graphic tools, including as the root locus, the Bode plot, and the Nyquist plot, to analyze systems and create lead, lag, and lead-lag compensators is discussed.

Objective

The objectives of the course are to:

1. Explain different components of control systems such as plant, process, inputs, outputs, controller, disturbance;

2. Develop mathematical models for mechanical translational and rotational spring-damper systems, passive electrical networks, operational amplifiers, and electromechanical systems (electric motor and generator);
3. Explain the use of the Laplace transform and theorems in the transient and steady-state analysis of continuous-time systems;
4. Explain the technique for block diagram reduction and signal flow graph for computation of system transfer function;
5. Explain the use of Routh's array to test system stability based on system characteristic polynomial;
6. State and techniques for sketching root locus and the application of root locus to control system analysis and design; and

Describe the design of phase-lead and PID controllers using root-

Learning Outcomes

7. locus methods.

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

1. Classify control systems based on signal type into Analog/Digital, Linear/Nonlinear, and Time-varying/Time invariant;
2. Design differential-equation models for electrical circuits and mechanical-translational, mechanical-rotational, and electro-mechanical systems;
3. Compute system transfer functions and reduced block diagram to rational-polynomial transfer function using either diagram manipulation or Mason's rule;
4. Apply all cases of the Routh test to determine system stability, or to determine ranges of some controller parameters for system stability;
5. Sketch root-locus plots and determine the gain K that places roots at a certain point on the root locus plot; and d
6. Design phase-lead and PID controllers using root-locus methods

Course Contents

Introduction to control systems. Comparison of open-loop and closed-loop configurations. Developing mathematical models of dynamic systems, including mechanical, electrical, electromechanical, and fluid/thermal systems. Models' representation in the transfer function, block diagram, signal flow graphs, and state space form. Transient and steady-state analysis of continuous-time systems. The basic control system design problem. Stability in control systems:

Stability testing using Routh-Hurwitz criteria. Root-locus analysis and design of control system: phase-lead and PID controllers using root-locus methods.

SUMAS EEE 403: Digital Signal Processing (2 Units; E; LH: 30)

Senate Approved Relevance

Engineering research, engineering practice, and society at large have all been greatly impacted by developments in electronics and digital systems. Digital signal processing (DSP) techniques are used to process analog signals more quickly and effectively. This establishes the groundwork for the digital transformation, which has affected every aspect of business and daily life. High levels of interpersonal communication and digital information have been produced with DSP at smaller, faster, and less bandwidth-intensive sizes. DSP enables the achievement of all SDGs 1 through 15 since it allows for the digitization of every aspect of life. This training is crucial to the growth of any country, but particularly to the creation of the workforce of the future.

Overview

The fundamental ideas and principles of digital signal processing are covered in this course, along with the conversion of analog signals into discrete-time signals and other types of signal processing. Discrete linear systems, their characteristics, and potential applications are covered in the course. The Fourier, Fast Fourier, Discrete Fourier, and Z-transforms, among other analytical methods for signal processing, are explained throughout the course. The course describes the process for designing digital filters-Infinite Impulse Response (IIR), Finite Impulse Response (FIR) filters, their properties, advantages and disadvantages. It also discusses windowing methods for truncating the roll-off of digital filters.

Objectives

The objectives of the course are to

1. Explain the analogue to digital conversion of signals through sampling, filtering, quantization and coding
2. Describe how sampled signals are converted to discrete-time signals.
3. To describe discrete linear systems and their properties
4. To explain how tools such as Fourier Transform (FT), Fast Fourier Transform (FFT), Discrete Fourier Transform (DFT) and Z-transform are used to analyse and process signals.

5. Explain how digital filters such as Infinite Impulse Response and Finite Impulse Response filters are designed.
6. Explain different properties and types of digital filters.
7. Demonstrate how windowing techniques (Hamming, Hanning, Blackman etc.) are used in truncating the roll-off of digital filters.

Learning Outcomes

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

- 1) Understand analytical tools such as Fourier transforms, discrete Fourier transforms, fast Fourier transforms, and Z-transforms required for digital signal processing;
- 2) Estimate spectra of discrete-time signals using the fast Fourier transform (FFT) in MATLAB and implement the FFT on a DSP chip;
- 3) Determine and interpret the z-domain transfer function of a discrete-time system and design discrete time filters in the z-domain using the pole-zero method;
- 4) Design different types of digital filters – Infinite Impulse Response (IIR) and Finite Impulse Response (FIR) filters;
- 5) Design and realise various digital filters in MATLAB for digital signal processing; and
- 6) Understand the applications of DSP in speech processing and spectrum analysis.

Course Contents

Discrete signals and systems with an emphasis on sampling and quantization. Introduction to DSP hardware architecture, including fixed-point vs. floating-point processors and the multiply-accumulate unit. Z-transform, Convolution and spectral analysis, digital Fourier transform, fast Fourier transform. The approximation problem in network theory. Synthesis of low-pass filters; spectral transforms and their application in the synthesis of high-pass and band-pass filters. Digital filtering, digital transfer function aliasing, pole-zero analysis of discrete-time systems, and pole-zero-based digital filter design, one-dimensional recursive and non-recursive filters. Computer techniques in filter synthesis, a realization of filters in hardware and software; Analysis of FIR and IIR discrete-time systems with an emphasis on phase response. Design and implementation of FIR digital filters. Design and implementation of IIR digital filters and basic image processing concepts.

Senate Approved Relevance

Understanding electromagnetic fields and waves, as well as how electric and magnetic waves act in various material mediums, is necessary for preparing graduates with a strong foundation in electronic and electrical engineering as well as allied subjects like computer, Mechatronics, and biomedical engineering. The purpose of this course is to give the students the information and abilities necessary to build engineering systems and equipment that utilize electromagnetic fields. The applications of electromagnetism to contemporary communication technologies including wireless, guided waves, and fiber optics will also be taught to the students. This will be helpful for the development, design, and analysis of communication networks.

Overview

The principles and theorems controlling electrostatics, magnetic fields, time-varying fields, the wave (Helmholtz) equation, Maxwell equations, and boundary conditions are covered in this course as a continuation of Electromagnetic Fields and Waves I. The emphasis of the course is on using these ideas to create electromagnetic-based tools and systems. The Helmholtz equation solutions for electromagnetic wave propagation in free space and guided systems are to be examined in this course. The radiation theory, different types and classifications of antennas, antenna design, and theorems governing the radiation antenna are also well elaborated in this course.

Objectives

The objectives of this course are to

1. Review basic electromagnetic principles and theorems, Maxwell equations and Poynting vector;
2. Describe the solutions to the wave (Helmholtz) equation and apply different boundary conditions in different material media;
3. Discuss the transmission line, reflection and transmission along the line, the resulting standing wave and power loss and how to minimize the power loss through impedance (stub) matching;
4. Describe the use of the Smith chart for impedance (stub) matching and solving other transmission line problems;
5. Explain wave propagation in guides, free-space and fibre optics;
6. Familiarize the students with the radiating antenna and the parameters used to characterize antenna types and properties;

7. Describe radio wave propagation and the underlining theorem affecting near-field and far-field radiation of an antenna;

Learning Outcomes

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

1. Describe the fundamentals of electromagnetic wave propagation;
2. Use the Smith chart to solve transmission line problems and stub matching;
3. Analyse wave propagation in free space and other material media and guide;
4. Design modes of propagation in waveguides and resonators; and
5. State five types of antennae
6. Design wire antennas, arrays and dishes.

Course Contents

Review of Maxwell equations, wave (Helmholtz) equation, Poynting vector. Review transmission line theory. Reflection and transmission of waves at interfaces. Standing waves. Impedance matching (single and double stub). Use of smith charts for solving transmission line problems. Propagation of electromagnetic waves in free space and different material media. Transverse Electric (TE), Transverse Magnetic (TM) and Transverse Electromagnetic (TEM) waves. Waveguide terminations. Mode excitement in waveguides and resonators. Antennas, radiating elements, antenna theory, radiation, diffraction. Basic antenna parameters such as directivity, gain, effective area, effective resistance, signal-to-noise ratio, near-field and far-field radiation patterns.

SUMAS EEE 409: Power Electronics (2 Units, E, LH: 30)

Senate Approved Relevance

The goal of the course is to enable graduates to address multidisciplinary issues connected to energy conversion, the integration of renewable energy systems, and energy efficiency. The course will assist in the development of skills and advancement of knowledge in these areas. Additionally, graduates will have the chance to develop real-world expertise in the analysis, design, and implementation of power conversion systems in significant industrial sectors. Graduates will have the intellectual capacity and transferable abilities required for the analysis

and synthesis of engineering problems. Graduates will be able to fill a range of industrial professions, from specialized technical positions to managerial positions. The graduate's employability and management abilities will both improve because of the training.

Course overview

The primary goal of the course is to introduce the basic ideas behind the conversion, regulation, and monitoring of electric energy utilizing power semiconductor devices. The methods for examining power electronic converters suited for converting electrical energy between AC/DC, DC/DC, and DC/AC are described. Also established are design guidelines for power semiconductors and passive components in power electronic converters. Presently discussed is the use of power electronic converters in fields related to renewable energy technologies, including electrified transportation, wind, solar, and electrical energy storage. The use of power electronics in the future electric power grid for transmission, distribution, and control is also outlined.

Objectives:

The objectives of the course are to:

1. Introduce students to the basic theory of power semiconductor devices and passive components, their practical applications in power electronics;
2. Familiarize students to the principle of operation, design and synthesis of different power conversion circuits;
3. Identify the most important design parameters and to recognize the impact of operating parameters on the performance of power electronic converters;
4. Understand the different application and requirements of power conversion circuits.
5. Analyze and design different power converter circuits;
6. Assess the performance of power converter circuits at the system level;
7. Provide strong foundation for further study of power electronic circuits and systems

Learning Outcomes

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

1. Understand the principles of power control by switching; demonstrate the benefits of switched mode circuits; be familiarised with the commonly used semi-conductor switching devices;
2. Demonstrate a full understanding on several DC-DC converters; perform analysis on their operation principles; develop design equations for selecting their components;

3. Be able to explain how the steady-state AC voltage and current are related to each other in power circuits using phasor analysis;
4. Understand and be able to quantify active, reactive and apparent power;
5. Comprehend the operation principles for several thyristors-based rectifiers; quantify the current harmonics and the average power drawn by a rectifier;
6. Understand the H-bridge based inverters and their several control methods; develop the skills in analysing the different modes of operations for the inverters; gain the understanding on how the power is delivered or absorbed by grid-connected inverters.

Course Contents

The basics of three-phase circuits, connections, voltage and current analysis and real and reactive power calculations. The fundamentals of electricity conversion from the form supplied by the source to the forms required by the load. Power electronic conversion techniques, including the basic converters (DC-DC, AC-DC and DC-AC) and their power switching and control methods. The methods of circuit analysis applicable to switched mode circuits. Essential properties of the relevant semiconductor devices. Simple converters for practical applications. Characteristics of power devices. DC-DC converters. AC Current, Voltage and Power. Effects of power electronics on AC power Rectifiers (AC-DC converters) and Inverters (DC-AC converters).

SUMAS EEE411: Communication Principles

(2 Units; C: LH: 30)

Senate Approved Relevance:

The information, abilities, and transferrable skills that are needed to build, implement, debug, maintain, and comprehend systems for communication engineering will be developed through this course. As a result, our graduates will gain knowledge and technical proficiency in the fields of communication engineering and its related disciplines, making them better prepared to work for themselves, be employed as professional engineers, advance to the level of registered engineer, or pursue a variety of other careers.

Overview:

Modern information processes are at their core communication systems. This course covers the fundamental methods utilized in such systems, along with their theoretical foundations, whether they are found in older AM and FM radio broadcasting stations, modern 5G and higher generation smart phones, or television broadcasting stations. The lessons will teach the pupils the

fundamental analog and digital communication strategies that serve as the cornerstones of more elaborate communication systems.

Objectives:

The objectives of the course are to:

1. Be able to know what Modulation is;
2. State at least four reasons for modulation;
3. Identify different types of Modulation schemes;
4. Compare the various types of Modulation based on generation, transmission and detection;
5. Highlight and explain the applications of different Modulations schemes;
6. Discuss AM broadcasting;
7. Describe FM broadcasting;
8. Explain TV broadcasting in relationship with the different modulation format;

Learning Outcomes:

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

1. Explain the purpose of modulation;
2. Describe the different types of modulations techniques, state how they differ and identify the limitations in their application;
3. Discuss the broadcast bands and specifications of different modulation techniques.
4. Describe the evolution of TV systems;
5. Prescribe the best modulation technique for different broadcast scenarios.; and
6. Explain engineering fundamentals of photo-generation, photo-detection and light- wave propagation for optical communications.

Course Contents:

Modulation. Reasons for modulation. Types of modulation. Amplitude modulation systems. Comparison of AM systems. Methods of generating and detecting AM, DBS, SSB signals. Frequency mixing and multiplying, applications of AM systems. Frequency modulation systems. Instantaneous frequency, frequency deviation, modulation index, Bessel coefficients, significant sideband criteria, bandwidth of a sinusoidal modulated FM signal, power of an FM signal, narrowband FM, direct and indirect FM generation. Various methods of FM demodulation; discriminator, phase-lock loop; limiter, pre-emphasis and de-emphasis, stereophonic FM

broadcasting. FM broadcast band specification, block diagram of FM radio receiver, limiter and ratio detector, automatic frequency control, squelch circuit, FM mono and FM stereo receivers. AM broadcast band and specification. FM broadcast band and specification. Image frequency. FM mono and FM stereo receivers. Comparative study of modulation techniques on S/N ratio basis: the effect of noise on different modulation techniques; figures of merit; amplitude modulation in the presence of noise; noise in digital communication systems and how it may be handled. The Super-heterodyne and its basic operation. Frequency Division Multiplexed systems. FDMA, TDMA, Principles of angle modulation, frequency and phase modulation, narrow and wide band FM, generation and demodulation of FM signals, phase locked loops, application of FM.TV broadcast band and specification. Signal format, transmitter, and receiver block diagrams of Black and White TV, and Color TV. Transmission media. Optical fibres: single mode, multimode. Optical cables. Wavelength division multiplexing (WDM): Dense wavelength division multiplexing (DWDM).

SUMAS EEE 413: Electrical Power Principles

(2 Units; E: LH: 30)

Senate Approved Relevance:

One of the main goals of developing the Electrical/Electronic Engineering program is to provide students in-depth understanding of electrical power in order to address the power issue in the Nigeria. Students enroll in the course Electrical Power Principles in order to achieve this goal and get in-depth understanding of the power system's electricity generation, transmission, and distribution. Additionally, students are exposed to current techniques for voltage control, power station supply economics, and factors to take into account when siting power plants. The information, skills, and competences that underlie the operation of the various electrical power system components are imparted to the learners through the study of electrical power principles. In order for the students to function effectively in the power supply business, this course gives them the necessary knowledge of power system operation.

Course Overview:

A network of electrical devices used to produce, transmit, and distribute electricity for consumer consumption is known as an electric power system. Thus, it is crucial for students studying electrical engineering to comprehend how electricity is produced, transmitted, and distributed for consumer use. The several considerations that had to be taken into account while locating the power stations are examined. This course introduces students to the various types of electrical power stations, such as hydro power stations and thermal power stations, and how they generate

electricity. Different types of tariffs are also taken into consideration along with the economics of the stations' operations. DC and AC distribution systems are also looked at, with the best one being highlighted. At the distribution level, the course included crucial subjects including power factor correction methods, load forecasting techniques and voltage control techniques.

Objectives:

The objectives of the course are to

1. Identify different types of power stations such as hydro-and thermal power stations;
2. Explain substation power supply economics;
3. Explain, compare and contrast different types of power factor correction methods;
4. Analyze different types of tariffs and determine the best one for any application;
5. Describe DC and AC power distribution systems;
6. Expose students to conventional and modern voltage control techniques;
7. Identify factors responsible for siting power plants;
8. Describe, compare and contrast different types of load forecasting;

Learning Outcomes:

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

1. Identify and explain the types of power stations; their operations and economic tariffs;
2. Explain the effects of power factor correction;
3. Describe and explain the polyphase theory, power distribution and network calculations;
4. Explain the effect of corona on overhead line cables;
5. Describe how to apply voltage control, concept and operation of circuit breakers; and
6. Explain the concept of load forecasting and siting of generating plants.

Course Contents:

Introduction to power systems and sources of energy e.g. conventional energy sources. Nuclear power, hydro fossil fuel. Coal, oil and gas, geothermal. Renewable energy sources: solar energy, wind, Biomass, Tidal. Other sources include magneto-hydrodynamic (MHD), structure of electric system, Generation. Load forecasting & Characteristics. Energy transmission and distribution line impedance; per-unit systems; voltage regulation; Transmission losses; Resistances, corona, skin & proximity effect; construction of overhead lines and underground cables. Restructuring, competition and deregulation in electric power industry: causes, types and effects of restructuring, the six networks of electric power industry, changing customer

requirements. Types of power station, operation, auxiliaries, economics of operation - stations, substations power supply economics, tariffs. Power factor correction. Polyphase theory. DC, AC power distribution, network calculations, Overhead line conductors. Corona effect, voltage control, circuit breakers, load forecast, siting of generating plants.

SUMAS EEE 415: Engineering System Modelling and Simulation (2 Unit, E: LH 30)

Senate Approved Relevance:

A course on engineering modeling and simulation will aid in equipping engineering students with the necessary understanding and expertise in modeling and simulation. Additionally, it will increase knowledge and proficiency in the fields of simulation and system modeling. Modeling and simulation are essential for having a well-functioning engineering design, and this is what the course should do. It is anticipated that our graduates will be capable of mastering modeling and simulation. This is consistent with SUMAS mission to promote sustainable development, intellectual and personal growth, as well as contribute purposeful service to the region and the nation at large

Course Overview:

All contemporary engineering designs and systems are based on engineering modeling and simulation. The fundamental methods used in system modeling and simulation from an engineering perspective are covered in this course. The course also seeks to teach students of electronic and electrical engineering modeling and simulation techniques that will help them develop into excellent engineers.

Objectives:

The objectives of the course are to:

1. Discuss what engineering modeling means;
2. Explain the meaning of simulation;
3. Know how to model practical engineering problems;
4. Describe formalisms and simulation tools relating to simulating human-centred engineering systems;
5. Use physical and logical representation of a given system to generate data;
6. Employ the use of models as a basis for simulations; and
7. Demonstrate the knowledge acquired in actual modeling and simulation exercises;

Learning Outcomes

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

1. Comprehend the techniques of modelling in the context of hierarchy of knowledge about a system;
2. Develop the capability to apply the same to study systems through available software;
3. Explain different types of simulation techniques; and
4. Simulate models for the purpose of developing and apply software.

Course Contents

Introduction: System, environment, input and output variables, State variables; Static and Dynamic systems; Hierarchy of knowledge about a system and Modelling Strategy.

Physical Modelling: Dimensions analysis; Similarity criteria and their application to physical models. Modelling of System with Known Structure: Review of conservation laws and the governing equation for heat, mass and momentum transfer. Deterministic model; distributed parameter models. Lumped parameter models in terms of differential and difference equations. State space model, transfer functions block diagram and sub systems, stability of transfer functions, modelling for control. Neural Network Modelling of Systems; Neurons, architecture of neural networks, knowledge representation, learning algorithm. Multilayer feed forward network and its back propagation-learning algorithm. Application to complex engineering systems and strategy for optimum output. Modelling Based on Expert Knowledge. Fuzzy sets, Membership functions, Fuzzy Inference systems, Expert Knowledge and Fuzzy Models. Design of Fuzzy Controllers. Optimisation and Design of Systems. Summary of gradient based techniques: Non-traditional Optimisation techniques (1) Genetic Algorithm (GA)- coding, GA operations elitism. Application using MATLAB. Simulation of Engineering Systems; Monte-Carlo simulation. Simulation of continuous and discrete processes with suitable examples from engineering problems.

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 organization /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 devise impactful solutions to them; and
5. Exploit the opportunity to improve and utilize 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.

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 – organizational, 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. Optimization, 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, organizing 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 Remedied. 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 Projects I & II (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.

SUMAS EEE 503: Control Engineering II (Modern Control Engineering) (2 Units; C; LH: 30)

Senate Approved Relevance

The goal of SUMAS is to produce Electronic and Electrical engineering graduates who can comprehend and use various state space tools for system performance and stability analysis, as well as design controllers for systems with a variety of signals in the time domain. Graduates who have a basic understanding of control system engineering and the concept of mathematical modeling of the physical system are in line with this goal. Produce graduates with the necessary training and technical proficiency in system analysis and design that can be applied to the manufacturing, electrical and electronic, telecommunication, power systems, and computer engineering industries.

Overview

The introduction to control system analysis and design in the time domain using the state-space approach is the core topic of this course. Systems representation in state-space, conversion from transfer functions, and similarity transformations between state-space forms are all presented. The description of methods for the homogeneous and forced solutions to the state equation follows this. State-space systems' asymptotic, internal, BIBO, controllable, and observable stability are all presented. The design phase starts with the design of the pole location and continues with the full-order and reduced-order designs of the observers. It discusses how servo systems are designed. The design of control systems with observers and regulator systems with observers is also covered. A discussion of quadratic optimum regulator systems finishes the course.

Objective

The objectives of this course are to:

1. Describe the transformation of system models from the transfer function model to the state-space model and vice versa;
2. Explain state transformation from one coordinate to another through similarity transformation;
3. Perform system modal decomposition by putting the system into diagonal form;
4. Explain techniques to solve the state equation to evaluate the homogenous and forced system response;
5. Discuss the concept of stability and distinguish clearly among asymptotic, BIBO, and internal stability;
6. Explain the concepts of controllability and observability, and the computation of controllability and observability matrices;
7. Discuss pole placement technique and the design of observers, both full and reduced-order
Observers;
8. Introduce the design of type 1 servo systems, regulator systems with observer, and control systems with observer; and
9. Describe Quadratic optimal regulator systems.

Learning Outcome

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

1. Perform system modeling and model transformation in state space;
2. Compute similarity transformation matrix to transform a system to modal form or another

coordinate;

3. Evaluate both the homogenous and forced system response;
4. Develop stability analysis of the state space system;
5. Use the pole placement technique to stabilize an unstable system;
6. Design servo systems to solve tracking problems; and
7. Design full-order and reduced-order observers for regulator and control systems.

Course Content

Introduction to modern control theory. State space representation: Phase and dual phase-variable forms, physical state variables, and transfer function. State transformations and diagonalization: Diagonal forms, diagonalization using partial fraction expansion. Time response from state equation. First order and higher order system response, Laplace transform solution. Stability: Asymptotic, BIBO, and Internal stability. Controllability and Observability. State Feedback and Pole placement. Design of servo system. State observers, Design of regulator systems and control systems with observers. Quadratic optimal regulator systems

SUMAS EEE 505: Digital Communications: System and Principles (2 Units C: LH: 30)

Senate Approved Relevance:

In order for our graduates to be prepared to enter self-employment, employment as professional engineers, and progress on to Registered Engineer or a wide range of other careers, this course will help to develop knowledge, skills, including transferable skills, such as design, installation, troubleshooting, maintenance and understanding, as well as awareness and technical "know how" in the fields of Communication engineering and its related disciplines.

Overview

Digital communication is a more current technology than analog communication, and it offers superior improvements. This most recent technology controls radio signal transmission for efficient information dissemination over a larger bandwidth. Techniques for digital modulation, error detection, and correction are covered in this course. Additionally, it gives a thorough understanding of how optical fiber technology works, enabling faster, better signal transmission for worldwide coverage and information accessibility.

Objectives:

The objectives of the course are to:

1. Understand types of digital modulation techniques;
2. Highlight the difference between digital and analog modulation;
3. Discuss the importance error detection;
4. Highlight types of error detection and correction techniques;
5. Explain the principles of operation of optical fiber;
6. Highlight types of optical fiber; and
7. State at least three advantages of optical fiber techniques over other signal transmission media.

Learning Outcomes

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

1. Explain types of digital modulation techniques;
2. Understand correction coding and decoding techniques;
3. Explain principles of optical fiber;
4. List optical fiber performances;
5. List fiber optics system standard; and
6. Illustrate optical fiber testing

Course Contents

Inter-symbol interference (ISI). Matched filtering. Equalizers. ASK, FSK, GPSK, DPSK with noise, phase referencing and timing. Correction coding. Decoding. The optical fibre description. Optical fibre principles. Types of optical fibre, optical fibre performance, fiber optics source and detectors. Standard fibre optics systems, fibre optics switching and multiplexing and fiber optic testing.

SUMAS EEE 507: Industrial Electronics Design (2 Units; E; LH 45)**Senate Approved Relevance**

This is necessary to produce outstanding electronic communication engineers who can serve as role models, who are independent thinkers, who are familiar with the theoretical concepts and technical principles that underlie contemporary technological breakthroughs. In order to manage both local and global difficulties in industry, students must also have entrepreneurial abilities and

a sense of social responsibility for design and construction of electronics devices that meet up with the challenges in industry.

Overview

The learner is given an introduction to the various electronic systems and components used in contemporary industry. Operational amplifier principles and applications are introduced. Complex analog circuits are constructed using operational amplifier circuits. The temperature controller and the pulse width modulation method of controlling the speed of a DC motor are two examples of these. Digital computers' significance in today's industrial operations is emphasized. We introduce thyristors, photosensitive components, optically connected components, timer control circuits, and various transducers.

Objectives:

The objectives of the course are to:

1. Learn about the digital ICs and sensory electronic devices;
2. Use tools/test equipment to analyze electronic components;
3. Design basic electronic circuits;
4. Learn about industrial control devices;
5. Perform electronics calculation;
6. Apply critical thinking in solving industrial electronic problems; and
7. Perform basic electronics troubleshooting.

Learning Outcomes

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

1. Explain basic elements of Industrial motor control: determine the use of different control devices and motor starters;
2. Understand fundamental elements of power electronics: diode-based rectifiers, harmonics and PF distortion, thyristor principles and control, thyristor-based rectifier and inverter;
3. Explain the operation of cycloconverter; SCR-based converter and triggering range and firing angles;
4. Analyse DC-to-DC switching converters, DC-to-AC switching converters and analyse PWM techniques in dc switching; and
5. Understand electronic Control of DC and AC Motors.

Course Contents

Solid-state devices and circuits; Programmable controllers; Characteristics and industrial

applications of thyristors and other SCR devices; Lasers; Fiber optics. Transducers and their applications in sensing light, voltage pressure, motion, current temperature, etc. Mechanical relays, solid state relays and stepper motors. Power supplies; Op-amp circuits; Open- and closed-loop (feedback) systems; Input devices; Output devices; AC and DC motors; Real time control and remote-control concepts in instrumentation. Motor control devices; Robots and other motion control systems; Data communications, Microprocessor and micro-computer-based systems. Fire alarms, burglar alarms, and general home and industrial instrumentation.

SUMAS EEE 509: Solid State Electronics

(2 Units; E: LH: 30)

Senate Approved Relevance:

This course is specifically tailored to the acquisition of knowledge about various materials and their electrical properties resulting into development of miniaturized and fast switching electronic devices with high power handling capability. In-depth knowledge of various types of material and their respective properties will make our graduates to be sound, competent and well-endowed professional engineers that will be at par with their contemporaries from any part of the world.

Course Overview:

Solid-state electronics deals with the study and development of nanoscale materials and devices to meet the continually increasing demand for ultra-high performance and extremely miniaturized electronic gadgets. This course provides an insight into the atomic structure, Rutherford model and its drawbacks, Bohr model and its drawbacks, wave mechanics and quantum mechanics, as well as band structure of solids. Also covered in this course are: Fermi level in intrinsic and extrinsic materials, elemental and compound semiconductors, phonon and photon, PN-junction devices and their characteristics. The course also provides an in-depth knowledge on the concept of degenerate semiconductors and, tunneling of electron, crystal structures and defects in crystal lattice, transport and optical phenomena in electronic devices such as photodiode, light emitting diode, liquid crystal display (LCD) etc. Various methods of IC fabrication are also considered in the course.

Objectives:

The objectives of the course are to:

1. Describe atomic structure based on the classical laws of physics;
2. Discuss the concepts of wave mechanics and quantum mechanics;

3. Discuss probability density function, Heisenberg uncertainty principle and Schrödinger wave equation;
4. Describe charge carrier concentrations, mobility and conductivity;
5. Compute Fermi level in intrinsic and extrinsic semiconductor;
6. Identify crystal structures and defects in crystal lattice; and
7. State some solid-state electronic devices such as diode, transistor, integrated circuits (IC) as well as optoelectronic devices like LED, LCD, etc.

Learning Outcomes

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

1. Explain energy band theory of solids;
2. Understand the element of solid-state theory;
3. Have detailed understanding of Schrödinger equation, harmonic oscillator, perturbation theory;
4. Discuss classical and quantum distribution functions; and
5. Distinguish between zener and avalanche breakdown.

Course Contents

Elements of solid-state theory required to understand modern solid-state devices. Topics include: Schrödinger equation, harmonic oscillator, perturbation theory, classical and quantum distribution functions, density of states; thermo-dynamical functions, relation to statistical mechanics; energy band model, lattice vibration and phonons; semiconductor; donor-acceptor statistics, transport properties.

SUMAS EEE 511: Microprocessor and Embedded System Design for Electrical Engineers (2 Units, E, LH: 30)

Senate Approved Relevance:

This course will assist in the development of knowledge, skills, and transferable competencies necessary for microprocessor and embedded system design interfaces and programming,

ensuring that graduates are well prepared to start their own businesses, work as professional engineers, become registered engineers, or pursue a wide range of other careers.

Course Overview:

In contemporary engineering systems, microprocessor and embedded system design applications are used. Introduction to embedded hardware level programming, introduction to microcomputer interfaces, and introduction to embedded systems are all topics covered in this course.

Objectives:

The objectives of the course are to:

1. Introduce student to processors architectures, microcontrollers used in embedded systems;
2. Introduce student to CPU, memory and input output units and Interrupts;
3. Introduce student to programming in assembler, programming in C, and development platforms for embedded software;
4. Introduce students to Digital I/O, Serial I/O, and Timers;
5. Introduce students to Analog-to-digital conversion; and
6. Introduce students to Pulse Width Modulation (PWM).

Learning Outcomes

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

1. Analyse and explain the basic building blocks of embedded systems hardware;
2. Identify relevant components and building blocks for embedded solutions;
3. Evaluate different embedded system architectures;
4. Describe the hardware and software architecture of processors used in embedded systems;
5. Use embedded system development platforms and environments;
6. State relevant embedded systems requirements such as memory, processor speed and energy consumption;
7. Develop experience in assembler and C programming languages; and
8. Build embedded system solutions with the help of common hardware interface units

Course Contents

Introduction to microcomputers and embedded systems. Processor architectures, microcontrollers used in embedded systems. CPU, memory and input output units; Interrupts. Introduction to hardware level programming of embedded system. Programming in assembler, Programming in C. Development platforms for embedded software. Introduction to

microcomputer interfaces: Digital I/O, Serial I/O, Timers, Analog-to-digital conversion. Pulse Width Modulation (PWM).

SUMAS EEE 513: Satellite and Microwave Communications (2 Units, E, LH: 30)

Senate Approved Relevance

In line with the goal and mission of SUMAS, training highly qualified graduates who are highly talented in the design and analysis of communication systems will help advance society and serve humanity, both in Nigeria and globally. When completely implemented, this course can significantly contribute to the achievement of the stated vision and objective.

Course Overview

This course is intended to give students the knowledge they need to comprehend satellite communication systems. It provides a strong foundation for orbital mechanics and satellite communication missions. Through the use of orbital equations for satellites in space and Kepler's laws of planetary motion, this course aims to impart fundamental concepts of satellite communications, understanding of major satellite components, and applications of satellite communications. The design of satellite links, various modulation techniques used in satellite communications, various multiple access schemes that are pertinent to satellite communications, and their network topologies are also covered in this course. In the course, microwave and its significance are covered.

Objectives

The objectives of this course are to:

1. Let students know what satellite is;
2. Understand how satellite communications work;
3. Prepare students to be successful in basic knowledge of satellite communication principles;
4. Provide students with solid foundation in orbital mechanics and launches for the satellite communication;
5. Understand Kepler's laws of planetary motion;
6. Provide students with different techniques employed in satellite communications;
7. Train students with a fundamental knowledge of link design of satellite;
8. Discuss multiple access systems and earth station engineering;

9. Use microwave components such as isolators, couplers, circulators, Tees, etc. in engineering microwave devices;
10. Understand basic microwave devices; and
11. To expose students to the basic methods of microwave measurements

Learning Outcomes

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

1. Determine the location of a satellite in space;
2. Explain Kepler's laws vis-à-vis their application to the location of satellite in orbit;
3. Differentiate between Earth segment and Space segment of a satellite communication system;
4. Design a satellite uplink and downlink;
5. Identify the different techniques and trade-offs employed in communicating signals through a satellite;
6. Explain what is meant by Microwaves;
7. State different microwaves sources;
8. Discuss various microwaves components; and
9. Compute s-parameters of microwaves components

Course Contents

Orbital equations for satellites in space. Kepler's laws of planetary motion. Space segment-based satellite subsystems including Attitude and Orbit Control System (AOCS), Telemetry, Tracking, and Command (TTC) system, Power Subsystem, Communication Subsystem, Antenna Subsystem. System noise temperature, G/T ratio, Downlink design, Uplink design, Design for specified C/N. Design examples. Analogue and Digital modulation techniques employed in satellite communications including: FM transmission by satellite, SCPC FM links, Digital transmission, Digital Modulation/Demodulation, Digital transmission of analogue signals. Various multiple access schemes relevant to satellite communications: Frequency Division MA, Time Division MA, Code Division MA, Spread Spectrum Transmission and Reception. Very Small Aperture Terminal (VSAT) systems. Their network architectures, Access control protocols, Basic techniques, and VSAT Earth Station engineering. Satellite systems: satellite classes; satellite orbits: Launching of a satellite and their monitoring. Low orbit satellites for mobile communication. Brief discussion of Microwave components: Tees, circulators, directional couplers, attenuators, phase shifters, S-parameter analysis of microwave components.

Microwave sources: Klystron, microwave semiconductor devices, low noise microwave amplifiers, parametric amplifiers.

SUMAS EEE 521: ELECTRICAL MACHINE DESIGN (2 units, E; LH: 30)

Senate Approved Relevance

This course will help to improve knowledge and abilities that include transferrable skills such equipment design, maintenance, insulation, temperature control, and manufacturing tactics. Power System Engineering and Machines, as well as its related disciplines, place a high priority on technical awareness and "know how" so that our graduates will be well-prepared to start their own businesses, work as professional engineers, and advance to Registered Engineer or (equivalent status) or a variety of other professional careers.

Course Overview

Dimensioning of the magnetic circuit, electrical circuit, insulation system, cooling system or ventilation, and machine parts are all included in the basic design of an electrical machine. A designer is also frequently faced with a variety of issues, some of which may not have a single answer but rather several. The specific magnetic loading, specific electric loading, temperature rise, efficiency, length of air gap, and power factor are the main factors to take into account while developing a suitable electrical machine. A power converting device is a part of any electrical machine. A transformer transforms electrical power from electrical at one voltage level to electrical at another voltage level, a motor transforms electrical power into mechanical, and a generator transforms mechanical power into electrical. It is inevitable that some energy will be wasted during these energy conversion operations. Electric circuits and magnetic circuits conveying fluctuating flux are where energy is lost in electrical machines. Machine parts that are subject to mechanical friction suffer an additional loss. Therefore, among other things, this course covers the design of both AC and DC machines as well as the corresponding cooling techniques.

Objectives

The objectives of the course are to:

1. Understand various factors to be considered in electrical machine design;
2. List materials used for electrical machine design;
3. Identify various limitations involved in the design;
4. Understand the design fundamental concepts and design main dimensions;
5. Develop knowledge on principles of design of static and rotating machines;

6. Explain the thermal Design Considerations for Electric Machines; and
7. Understand cooling systems of transformers and main dimensions of rotating machine.

Learning Outcomes

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

1. Explain the principles of AC and DC Machines;
2. Understand magnetic materials for Electric machine, stator lamination and core design studies;
3. Explain the relevance of voltage and temperature in the design of stator insulation system;
4. Understand the principle and design strategy of induction machine;
5. Examine the design principle for synchronous generator, transformers and mechanical design issues for electrical machines; and
6. Understand manufacturing practices of electrical machines.

Course Contents

Principles of AC and DC machine design: Magnetic Materials for Electric Machines; Stator Laminations & Core Design Studies; Stator Insulation System vs. Voltage & Temperature. Phase Induction Machine Design Strategy; Equivalent Circuit, Measurements and Torque vs. Speed Plots; Rotor Design for Asynchronous Induction Machines; PM Synchronous Generator Design Principles; Thermal Design Considerations for Electric Machines; Electric Machine Cooling Strategies; Mechanical Design Issues for Electrical Machines; Manufacturing Practices of Electrical Machines. Design of transformer.

SUMAS EEE 523: ELECTRICAL POWER SYSTEM ENGINEERING (2 units, E; LH :30)

Senate Approved Relevance

The creation of a more satisfying life linked to the power sectors for the benefit of mankind, in Nigeria and throughout the world, can be facilitated by equipping and educating high quality graduates who are highly trained in the analysis, control, planning, and operation of power systems. This is vital to create electrical engineers that are outstanding role models, self-sufficient, and knowledgeable about the newest advancements in technology.

Course Overview

For power system planning, project engineering, operation, and power system rehabilitation for electrical power supply, power system engineering is a crucial area of activity. It includes the

examination of offers, including a technical and financial analysis, contract negotiations, and contract award. It also includes the study, calculation, and design of electrical systems and equipment. It is regarded as a crucial and essential component of engineering activities for feasibility studies, planning and operating studies, project engineering, the development, extension, and rehabilitation of existing facilities, the design of network protection concepts and protective relay settings, as well as for the clearing up of disturbances, such as those caused by short circuits. Nearly all facets of power system engineering are covered in this course, starting with a general approach like modeling, three-phase systems, transmission lines models, the choice of an appropriate system, and substation topology. The primary components of the power system, such as cables, transformers, and overhead lines, are also described in detail regarding their design and operational limitations. For the purpose of solving a non-linear load flow, load-flow analysis and various iterative methods are examined. Details on the power system protection are provided, along with information on short-circuit analysis.

Objectives

The objectives of the course are to:

1. Understand the concept of transmission lines with respect to three-phase systems and modeling;
2. Classify transmission lines into different types based on their respective lengths and explain the notion of reactive compensation of transmission lines;
3. Understand and describe operational concepts such as: flow of active & reactive power, voltage profile, steady-state stability, power flow limits and line load ability, voltage regulation, Surge Impedance Loading;
4. Identify and discuss various iterative techniques for load flow studies;
5. Explain various classification of buses in power system with respect to load flow studies;
6. Discuss modeling of Static AC-DC Conversion Plant;
7. Understand the disadvantages of high voltage direct current (HVDC) and its operation;
8. Explain the economic operation of power systems;
9. List and explain various components of a power system protection; and
10. Discuss power system protection schemes.

Learning Outcomes

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

1. Apply the knowledge of mathematics, and engineering to the analysis of electrical machines and transmission lines;
2. Design and conduct experiments, as well as analyse and interpret data;
3. Identify, formulate, and solve engineering problems in the area of electromechanical energy conversion devices;
4. Understand and apply some knowledge of contemporary issues concerning Electrical/Energy systems; and
5. Use techniques, skills, and modern engineering tools necessary for engineering practice.

Course Contents

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

Basic single-phase modeling. Three-phase system analysis. Three-phase models of transmission lines. Three-phase models of transformers. Formation of the system admittance matrix. Modeling of Static AC-DC Conversion Plant: Introduction. Rectification, inversion. Communication reactance. DC transmission. Load Flow: Introduction, Basic nodal-method. Conditioning of Y matrix. The case where one voltage is known. Analytical definition of the problem. Newton-Raphson method of solving load flow problem. Techniques that make Newton-Raphson Method competitive in load flow. Characteristics of the Newton-Raphson load flow method. Decoupled Newton load flow method. Fast Decoupled load flow. Convergence criteria and tests. Numerical examples. AC-DC Load Flow: Introduction. Formulation of the problem. DC system model. Solution techniques. Control of converter AC terminal voltage. Extension to multiple and or multi-terminal DC systems. DC convergence tolerance. Test system and results Numerical examples. Optimal operating strategies: Scheduling of generation, types generating stations and their techno-economic operating characteristics Fault analysis and Control strategy: types of system protection, generators, transformers, lines etc. protection schemes switchgear and circuit breakers operating principles and types.

SUMAS EEE 525: ELECTRICAL ENERGY UTILIZATION (2 units, E; LH = 30)

Senate Approved Relevance

This course will help to graduates who are highly adept and knowledgeable in electrical energy, effective usage and energy storage in line with our mission of producing Electronic and Electrical engineering graduates who are able to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics and to recognize ethical and professional responsibilities in engineering situations and make informed judgments which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts. Properly trained graduates who are able to acquire and apply new knowledge as needed, using appropriate learning strategies.

Overview

This course teaches how to obtain and use electrical power that complies with the required standards and has the specified voltage, current, and frequency. Traction effort, power, and specific energy consumption are calculated for a given route. Industrial and commercial building lighting system. Efficiency, performance, and environmental impact are prioritized in the analysis of unique factory drives, energy conversion, and storage.

The goal of this course is to analyze energy consumption technologies critically in light of the threat of global warming. Uninterruptible Power Supply, a renewable energy source, is the main focus. Installations of electrical regulations, the use of electrical apparatus, and metering rates are also covered.

Objectives

The objectives of this course are to:

1. Introduce the various concepts of energy, energy storage and energy conversion;
2. Design the lighting systems for commercial buildings;
3. Create ideas and participate effectively in discussions involving energy-conscious decisions;
4. Familiarize the students with the techniques to improve the power;
5. Carry out the calculations on values of components used in the Inverters;
6. Design the metering tariffs systems;
7. Become knowledgeable with the basic principles of energy storage; and
8. Familiarize the students with operation of electrical equipment.

Learning Outcomes

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

1. Understand and able to distinguish between industrial and commercial installation and lighting;

2. Know the importance of grounding an installation and regulations involve;
3. Calculate the total load of an installation and know the methods involved;
4. Know and understand how UPS and Inverter works. Also know the fundamentals of designing it and the calculation involves;
5. Understand the impacts of electrolysis and its application, electric heaters, electrical energy involves in welding; and
6. State different types of tariffs and power improvement.

Course Contents

Lighting system design for industrial and commercial building. General and special factory drives. Electric heating, space air-conditioning, Electrical welding, Electrolysis and its industrial applications. Grounding, Power improvement, Uninterruptible power supply (UPS). Regulations installations and operation of electrical equipment, Metering Tariffs systems.

SUMAS EEE 527: POWER TRANSMISSION AND DISTRIBUTIONS (2 units, E, LH: 30)

Senate Approved Relevance

Electrical power transmission and distribution has been a major issue in Nigeria, it is imperative to teach undergraduates this course. The course affords them to see the technicality involved in the electricity transmission and distribution logjam the country found herself. The opportunities in the power problem issues in Nigeria are well outlined. This is relevant to the overall vision of the University.

Course Overview

The focus of this course is on the generation and transmission of electrical power will be on the issues that affect engineers and technicians as they carry out their duties. Hydropower, thermal, nuclear, and wind power generating stations, transmission and distribution of electrical energy, direct current transmission, high-voltage direct current light transmission system, power stability, and cost of electricity are some of the subjects discussed.

Objectives

The objectives of this course are to

1. Perform transmission line simulation;
2. Describe nuclear, hydroelectric, and wind power generation systems;
3. Analyze transmission line voltages;
4. Compute power-flow analysis;
5. Perform transmission line calculations; and

6. Provide solutions to electrical power problems.

Learning Outcomes

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

1. Solve power analysis problems using graphical and analytical methods;
2. Calculate sag and tension on transmission line;
3. Apply matrix methods to solve power problems;
4. Perform charts on transmission and distribution; and
5. State different types of insulators and voltage distribution

Course Contents

Electrical parameters: Long line equations, analytical and graphical methods of solution for short medium and long lines. Performance charts. Application of Matrix methods. Circle diagrams and power limits of uniform long lines, Reactive power compensation. Insulators and Voltage distribution. Conductors, materials and configuration. Sag and tension calculations.

SUMAS EEE 531: ARTIFICIAL NEURAL NETWORK & PROGRAMMING (2 UNITS, E;LH:30)

Senate Approved Relevance

Generally, today, it is believed that the majority of the companies seen make use of AI technology in order to reduce cost and minimize man power. Therefore, students that have a knowledge of this course will find it very easy to get job in such companies. Our students in SUMAS in electrical and electronic engineering department will not miss such opportunity for job. This has necessitated this course. The relevance of the course is seen in electrical/electronic engineering lecturers being able to teach the student to develop the Artificial Intelligence (AI)-based systems (AI), discuss different types of neural networks, discuss the image processing applications as they are used in artificial intelligence, discuss Convolutional Neural Network (CNN). differentiate between Recurrent Neural Network (RNN) and Modular Neural Network (MNN), explain the components of an Expert System. It is expected that the graduates from electrical and electronic engineering in SUMAS who undergone through the course will always be in the front line in terms of teaching, learning and research.

Overview

Artificial Intelligence (AI) is a branch of science which deals with helping machines find solutions to complex problems in a more human like fashion. In this course, students will be taught how to develop the Artificial Intelligence (AI)-based systems (AI) , discuss different types of neural networks, discuss the image processing applications as they are used in artificial

intelligence. Students will still discuss Convolutional Neural Network (CNN). Furthermore, students will be taught how to differentiate between Recurrent Neural Network (RNN) and Modular Neural Network (MNN). Finally, they will be taught the components of an Expert System.

Objectives

The objectives of the course is to make students to:

1. Develop the Artificial Intelligence (AI)-based systems (AI)
2. Discuss different types of neural networks.
3. Discuss the image processing applications as they are used in artificial intelligence:
4. Discuss Convolutional Neural Network (CNN).
5. Differentiate between Recurrent Neural Network (RNN) and Modular Neural Network.
6. Explain the characteristics of Expert Systems.
7. Define advantages and five disadvantages of an Expert System.
8. Explain the components of an Expert System.
9. Discuss a typical Artificial Neural Network Layers.

Learning Outcomes

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

1. Discuss the Artificial Intelligence (AI)-based systems (AI)
2. Develop a graph of a logistic regression curve showing the probability of passing an exam versus hours studying.
3. Discuss different types of neural networks.
4. Discuss the image processing applications as they are used in artificial intelligence:
5. Discuss Convolutional Neural Network (CNN).
6. Differentiate between Recurrent Neural Network (RNN) and Modular Neural Network (MNN).
7. Explain the characteristics of Expert Systems.
8. Define advantages and five disadvantages of an Expert System.
9. Explain the components of an Expert System.
10. Discuss a typical Artificial Neural Network Layers.

Course Contents

Neural network: Definition of artificial neural network. Similarities of neural network with human brain. Classification of ANN. Terminologies: input/output sets, weights, bias or threshold, supervised learning, network training, convergence process, single layer vs multilayer perception, forward and backward propagation, gradient descent rule. Back propagation neural network, variable terms used in back propagation neural network, learning rate, momentum, hidden nodes, sigmoid activation function. Back propagation algorithm of ANN. Design of ANN model, training sets for ANN, test sets for ANN network testing and performance. Engineering applications. ANN programming.

Minimum Academic standards: As contained in the CCMAS

SUMAS EEE 533: ROBOTIC & AUTOMATIC SYSTEMS (2Units, E; LH:30)

Senate Approved Relevance

The relevance of the course is seen in Electrical and Electronic lecturers from SUMAS being able to discuss robot classification and manipulation, technology and history of development of robots. The lecturers will also focus on the application, direct and inverse kinematics: arm equation, workspace analysis and trajectory planning. differential motion and statics. Manipulator dynamics, end- of arm tooling, automation sensors. robot vision. Work-cell support systems. robot and system integration, safety. human interface, robot control system. Circuit and system configuration. It is expected that the graduates from Electrical and Electronic engineering from SUMAS who undergone through the course will always be in the front line in terms of teaching, learning and research.

Overview

Robotics is a field of science working with machines that perform tasks based on predetermined and adaptive programs and algorithms in an automatic or semi-automatic way. The course involves the technology and history of the development of robots, classifications and the manipulations involved in robots and the circuitry involved in the robot control systems. Also, numerical control and adaptive control involved in a robot system is dealt with in the course. The students will also be taught automation and robot application.

Objectives

The objectives of the course to students are to:

1. Discuss the technology and history of development of robots
2. Discuss Robot classification and manipulation
3. Discuss the direct and inverse kinematics: arm equation

4. Discuss the robot control system with respect to circuit and system configuration
5. Discuss the numerical control and adaptive control. Of robot system
6. Discuss various robot applications
7. Understand the fundamentals of automation

Learning Outcomes.

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

1. Discuss the technology and history of development of robots
2. Discuss robot classification and manipulation
3. Discuss the direct and inverse kinematics: arm equation
4. Discuss the robot control system with respect to circuit and system configuration
5. Discuss the numerical control and adaptive control of robot system
6. Discuss various robot applications
7. understand the fundamentals of automation

Course Contents

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

Minimum Academic standards:As contained in the CCMAS

SUMAS EEE 535: EMBEDDED SYSTEM DESIGN

(2Units,E;LH:30)

Senate Approved Relevance

Embedded system design has contributed its quarter in development of the state of arts in terms of computer and information technology in the world today. This has correspondingly attracted an increase in demand on such advanced technology worldwide. This has necessitated the need for computer engineering students of Madonna university, to key in and be part of such

technology. To achieve this aim, the students need to know the concept of an embedded system, know the components, characteristics and applications of embedded system, identify the pins configuration of Intel 8051/8031 micro-controller and their functions, Identify I/O port structure, identify different types of memory organization: write assembly language programming and have practical example involving the design of words using 8051micro-controller in seven segment display. At the end of these knowledge acquired, the students will be the best amongst other contemporary in terms of training and research.

Overview

During the duration of this course, students will understand the concept of an embedded system. The components, characteristics and applications of embedded system will be taught to students. Furthermore, students will learn how to identify the pins configuration of Intel 8051/8031 micro-controller and their functions. They will equally learn how to identify, I/O organizations and different types of memory organization. Students will also learn assembly language programming. Finally, students will have their hands on practical example involving the design of words using 8051micro-controller in seven segment displays

Objectives

The objectives of the course to students are to:

1. know the concept of an embedded system,
2. Know the components, characteristics and applications of embedded system
3. Identify the pins configuration of Intel 8051/8031 micro-controller and their functions
4. Identify I/O port structure
5. Identify different types of memory organization:
6. write assembly language programming:
7. Determine the 8051instruction set
8. Identify On-chip peripheral devices and functions: I/O
9. Develop hardware tools.
10. Practical example involving the design of words using 8051micro-controller in seven segment display.

Learning Outcomes

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

1. know the concept of an embedded system,
2. Know the components, characteristics and applications of embedded system
3. Identify the pins configuration of Intel 8051/8031 micro-controller and their functions

4. Understand I/O port structure
5. Identify different types of memory organization:
6. Write assembly language programming:
7. Determine the 8051-instruction set
8. Identify On-chip peripheral devices and functions: I/O
9. Develop hardware tools.

Course Content

Introduction to embedded system, components, characteristics, applications. Intel 8051/8031 micro-controller: features of the 8051/8031 family block diagram and definitions of the pin of the 8051, I/O port structure, memory organization: general purpose RAM, bit addressable RAM, register bank, special function registers, external memory, memory space mapping and decoding, bus control signals timing, a typical 8051 micro-controller-based system. Instruction set and assembly language programming: addressing modes, the 8051-instruction set and typical examples, assembler operation, assembly language format, assembler directives, operation of assemblers and linkers, programming examples. On-chip peripheral devices: I/O ports, operations and uses of port 0, port 1, port 2, port 3, timers: their operations, programming, and applications, serial port: operations and programming, typical applications, serial port interrupt. Interfacing to external memory, keypad, seven-segment LED display, ADC and DAC chips, and input/output port expansion, description and uses of hardware development tools. MOTOROLA M6811 Micro-controller: features of the M6811 family, block diagram and definitions of the pin of the M6811, I/O port structure, memory organization: general purpose RAM, bit addressable RAM, register bank, special function registers, external memory, memory space mapping and decoding, bus control signals timing. Instruction set and assembly language programming. On-chip peripheral devices and I/O interfacing. Introduction to IPC microcontroller: general architecture, applications and selection of microcontroller, advantages, low-end, and high-performance PIC. Specific PIC microcontrollers: features, architecture, block diagram, pin configuration, on-chip memory, and peripheral. Instruction set and assembly language programming. Serial I/O interfacing: 12C, and SPI interfacing and programming. Memory interfacing: external memory interfacing, EEPROM and flash memory interfacing. Design exercises using development system.

Minimum Academic standards: **As contained in the CCMAS**

SUMAS EEE 537: ADVANCED CIRCUIT TECHNIQUES (2 UNITS, E; LH: 30)

Senate Approval Relevance

Advanced Circuit Techniques deals with the design of advanced analogue circuits at systems level, including switching power converters, regulated power amplifiers and buffers. They are used in a wide range of applications including music systems, in driving industrial loads and elsewhere. The course enables the students to learn how to carry out the design of several advanced circuits such as multiplexers, analogue-to-digital converters (A/D), and digital-to-analogue converters (D/A). This is in line will produce graduates that are capable of designing complex systems in engineering, projects, and supervise their implementation in critical areas of electrical and electronic engineering and to add value in technology world.

Overview

The course involves studying the design techniques of advance analogue circuits containing discrete and hybrid electronics circuits like the operational amplifiers, differential amplifier, feedback amplifiers, and oscillators that are mostly used in advanced circuit designs. It involves also the study and use special computer packages to model and simulate complex circuits in electrical and electronic engineering fields. The knowledge of the course is used extensively in the automobile industry in engine control and car-entertainment systems. Also used in communication and entertainment applications such as telephoning and telegraphy, optical communication, wireless communication, etc. design of electronic gadgets.

Objectives

The Objectives of the Course are to;

1. Describe the principles of operational and differential amplifiers.
2. Describe the use of instrument amplifiers in circuit designs and conversion
3. Explain the concept of RF and communication circuits with oscillators.
4. Describe the principles of multiplier circuit and multistage amplifiers.
5. Explain circuit simulations using appropriate packages.

Learning Outcomes

On completion of the course, students are expected to;

1. Explain electronic systems built using discrete components and integrated circuits.
2. Design and analyse power electronic converters.
3. Explain radio frequency and communication circuits with filters and oscillators.
4. Analyse the operation of feedback and instrumentation amplifiers.

5. Describe the use PSPICE, Visio Technical, electronic work bench, and multisim in circuit simulation.

Course Contents

Analysis and design of integrated operational amplifiers. Advanced circuits. Waveband amplifiers. Instrumentation amplifiers. Multiplier circuits. Voltage controlled oscillators. Phase locked loops. Design techniques for advanced analogue circuits containing transistors. Design techniques for advanced analogue circuits containing operational amplifiers. Design techniques for advanced analogue circuits containing differential amplifiers. Simulation of circuits using appropriate computer packages. Electronic workbench, Visio technical. multisim.

Minimum Academic Standard: As per CCMAS.

SUMAS EEE 502: Reliability and Maintainability of EEE Components and Systems

(2 Units; C: LH; 30)

Senate Approved Relevance:

This course will assist in the development of knowledge, abilities, and transferrable skills necessary to pinpoint and address the root causes of failures in engineering systems as well as to prevent or lessen their frequency. As a result, our graduates will be prepared to start their own businesses, find employment as professional engineers, advance to the level of Registered Engineer, or pursue a variety of other careers. It will also apply engineering techniques to estimate the reliability of new designs and analyze reliability data to predict expected life of the specific component, product, or system.

Course Overview:

All engineering components, products, or systems are fundamentally built on testing, reliability, and maintainability. The application of availability, maintainability, and reliability to systems, products, and components is covered in this course.

Objectives:

The objectives of the course are to:

1. Describe the concepts of reliability, maintainability, and availability;
2. Apply these concepts to systems and electronic components;
3. List the characteristics of electrical and electronic components;
4. State different types of fault on a system;

5. Explain how to design systems for higher reliability;
6. Describe packaging, mounting, and ventilation; and
7. Explain how to protect systems, products, and components from humidity and dust.

Learning Outcome

At the end of this course, the student will be able to:

1. Apply engineering techniques to prevent or reduce frequency of failures;
2. Identify and correct the causes of the failures on engineering systems;
3. Estimate using engineering techniques the reliability of new designs;
4. Analyse reliability data;
5. Predict expected life of the specific component, product or system; and
6. Develop risk analysis and quality control on engineering systems.

Course Contents

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

SUMAS EEE 504: Advanced Renewable & Hydrogen Cells Energy System (2 Units; E, LH 30)

Senate Approved Relevance

This course fits in with our commitment to educating top-notch graduates who are knowledgeable about how to use renewable energy sources and hydrogen fuel cell technology in a variety of ways to improve the quality of life and the environment for all people in Nigeria's south-east region and around the world.

Course Overview

While hydrogen cells are a relatively new development in natural sources of energy, renewable energy systems are an endless natural source of energy. They entail the fundamental process of producing electrical energy from scratch using renewable natural resources. The course will introduce students to hydrogen cell technology and the advantages of renewable energy. Additionally, knowledge of the use of fossil fuels and their depletion as a cause of global warming is covered. In order to meet the ever-increasing load demand of current technological era in Nigeria and around the world, the course will prepare the students for life beyond school in the areas of design, generation, and use of renewable energy and hydrogen cell technologies.

Objectives

The objectives of the course are to:

1. Explain energy as relate to civilization evolvement;
2. State different sources of renewable energy: solar, wind, biomass, hydrogen system etc;
3. Describe the Greenhouse effect and the advantage of renewable energy;
4. Explain the fundamentals of Solar Power Systems, Photovoltaic Power Conversion, Photovoltaic Material, Modelling of Photovoltaic Systems, Design of Photovoltaic Systems, Concentrated Solar Power;
5. Describe the fundamentals of wind power systems wind power conversion, modelling of wind power systems, design of wind systems Provide exposure to the basics of hydrogen-based technologies to a large number of students;
6. Create a level of training that will serve to spark a high degree of interest in students who will then continue with more advance research;
7. Develop a “middle-level” training to a moderate level of students. More detailed and directed education will provide students with the ability to work to support industry and government development of hydrogen technologies;
8. Provide detailed training to a smaller subset of students with a strong interest and propensity to make significant contributions to the technology development. These individuals will have extensive hands-on experience through internships that will allow them to play a major role in industry, government, and academia;
9. Discuss the design of energy storage;
10. Explain the integration of distribution and generation into the grid dc/ac inverters, analysis of dc/ ac inverter dc/dc converters, and design of converters for grid operation.
11. Describe the impact of distribution and generation on power system operation, voltage variations circuit, overloading system protection, ride through and fault mitigation, power quality disturbances.

Learning Outcomes

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

1. Make interpretation about the energy sources;
2. Comprehend the energy and energy types; and adverse consequences of greenhouse gases;
3. Understand the various energy sources in Nigeria;
4. Explain the solar energy power plants;
5. Explain the solar energy collectors;

6. Make interpretation about the wind energy;
7. Explain the production of electricity from wind energy;
8. Explain the properties of hydrogen energy;
9. Describe the safety precautions in handling hydrogen;
10. Describe the different ways to produce and store hydrogen energy;
11. Compare and contrast hydrogen and conventional fuels;
12. Describe the importance and applications of fuel cell technology;
13. Define terms and components related to fuel cells;
14. Explain fuel cell operation and list various types of fuel cell;
15. Describe electrical components and ratings for fuel cells; and
16. Explain the past, present, and future state of fuel cells.

Course Contents

1. Energy and civilization, fossil fuels: availability and depletion, Nuclear Energy, Global Warming, Green and Renewable Energy Sources.
2. Estimates of energy costs, components of electric grid, electric energy outlook in Nigeria. Distribution and generation technologies and economics.
3. Fundamentals of Solar Power Systems Photovoltaic Power Conversion, Photovoltaic Material.
4. Modelling of Photovoltaic Systems, Design of Photovoltaic Systems, Concentrated Solar Power.
5. Fundamentals of wind power systems wind power conversion, modelling of wind power systems, design of wind systems.
6. Integration of distribution and generation into the grid dc/ac inverters, analysis of dc/ ac inverter dc/dc converters, design of converters for grid operation.
7. Impact of distribution and generation on power system operation, voltage variations circuit, overloading system protection, ride through and fault mitigation, power quality disturbances.
8. Hydrogen energy, Hydrogen Safety, Production and Storage.
9. Comparison of hydrogen fuel to conventional fuels.
10. Fuel cell- Definition, History, and Importance.
11. Fuel Cell-Types, Operations, and Applications.
12. Fuel cell Electrical Components and Ratings.
13. Energy storage and other renewable energy sources.

SUMAS EEE 506: Data Communications and Computer Networking in Electrical and Electronic Engineering

(2Units;C, LH:30)

Senate Approved Relevance

Graduates with a strong background in data communication and networking, in keeping with SUMAS goal of generating Electronic and Electrical Engineering graduates who can address the nation's data networking and communication demands. The significance may be observed in the fact that Nigeria's large population has technology needs given that the world is changing quickly and there is a need to stay up with global trends in networking and communication.

Overview

This course aims to educate undergraduate students on the elements of contemporary computer networks and data communication. The production of graduates with the technological know-how necessary to comprehend and put into practice computer network principles as well as principles of successful communication and information transfer is of immense significant, putting into practice various networking topologies and links for various enterprises, states, countries, and the entire planet. In order to prepare students who are sufficiently challenged by the country's communication and technical needs as well as the desire to create a global village, the topics have been carefully chosen. This course has made significant efforts to build the theoretical underpinnings of data communication and computer networks.

Objectives

The major objectives of the course are for the students to:

1. Discuss the characteristics and components of a data communication;
2. Understand computer networks and types of computer networks;
3. Explain network topologies;
4. Define OSI model and the internet model;
5. Explain the different transmission media;
6. Distinguish digital and analog transmission;
7. Describe multiplexing and switching; and
8. Explain computer security.

Learning Outcomes

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

1. Know the basic features of Data communications, protocol and network architecture;

2. Identify the features and benefits of major recovery mechanisms;
3. Know the OSI layers and their characteristics in communication system;
4. Distinguish between Internet protocol v4 and Internet protocol v6;
5. List importance of security and different type of security technique in wireless communication;
6. Explain the basic features of WAN systems, Peer-to-peer and client server network architecture; and
7. Apply the knowledge of various physical layer security to wireless communication.

Course Contents

Introduction to Data communications. LAN topology, access methods, signaling methods. WAN systems. Protocols: Introduction to network protocol. Seven Layer ISO-OSI standard protocols and network architecture. Peer-to-peer, Client Server. Client-Server Requirements. 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.

SUMAS EEE 508: Mobile and Wireless Communication (2 Units; E: LH 30)

Senate Approved Relevance:

In order for our graduates to be prepared to enter self-employment and employment as professional engineers and progress on to Registered Engineer or a wide range of other careers, this course will help to develop knowledge, skills, including transferable skills, such as design, installation, troubleshooting, maintenance and understanding, as well as awareness and "know how" in the fields of Communication engineering and its related disciplines.

Course Overview:

With the allocation of the best network resources, the discipline of communication engineering's mobile and wireless communication manages the portability of wireless terminals (handsets) while ensuring a dependable and efficient exchange of information. Our graduates in the field of communication engineering will benefit from this course since it will provide them with the foundational knowledge and necessary skills for a successful professional career. This course explores the methods used in satellite voice communications, fixed line telephony systems, mobile telephony systems, wide area packet data networks, and other new technologies to support ubiquitous and seamless connectivity of communication networks.

Objectives:

The objectives of the course are to:

1. Discuss access, multiplexing and signaling as it relates to fixed line telephony systems;
2. Discuss the importance of mobility management and network dimensioning on mobile telephony systems;
3. Discuss the standards and overview of analogue and digital cellular system;
4. Highlight and familiarize yourself with Internet Protocol and ATM application in wide area packet data networks;
5. Discuss role and importance in satellite voice communications, 3G mobile systems and beyond;
6. Discuss contemporary issues and emerging research areas in wireless and mobile communication systems and wide area data technologies; and
7. Demonstrate the interactions of commercial interests and technology standards as it affects human activities.

Learning Outcomes

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

1. Explain fixed line telephony systems, including access, multiplexing and signaling;
2. Elucidate mobile telephony systems, mobility management and network dimensioning;
3. Discuss wide area packet data networks, including Internet Protocol and ATM;
4. Demonstrate satellite voice communications and 3G mobile systems;
5. Expatiate contemporary and emerging research areas in new technologies (5G and 6G); and
6. Illustrate the interactions of commercial interests and technology standards.

Course Contents

Evolution and examples of mobile radio communications. Basic cellular system, frequency reuse, roaming, hand-off strategies, co-channel interference, traffic and grade of service. System capacity and improvement. Propagation path loss, multipath propagation problem, Raleigh fading, Rician distribution, Doppler Effect. Field strength prediction modes. Standards and overview of analogue and digital cellular system: AMPS, TACTS, GSM, CT2, PCN, DECT, PHS. Frequency management and channel assignment. GSM: architecture, elements and standard interfaces, FDMA/TDMA structure. Third generation wireless standards. Paging and SMS service technologies. Call processing. Signaling, roaming and mobility management, route optimization. Wireless communication system design, Radio Channel Properties: Path Loss, Fading, Doppler etc., Cellular Systems: Frequency reuse, interference, hierarchical cell

structures; Radio/Antennae types, Access Methods: FDMA, TDMA, CDMA, OFDM, Random access and packet transmission System Overviews, e.g. GSM, WCDMA and WLAN.

SUMASEEE 510: Antennas Theory and Propagation:

(2 units; E; LH:30)

Senate Approved Relevance

This course is designed primarily to help students learn about different antennas and their characteristics, radiation pattern, and applications, leading to quality transmission and reception of signal propagated in a particular medium. Our graduates will be sound, skilled, and well-endowed telecommunication engineers who will be on par with their contemporaries from any area of the world thanks to their in-depth understanding of numerous types of antennas and the corresponding propagation mechanism and attributes.

Overview

This course lays emphasis on antennal as a transmitting and receiving elements in communication systems. Students are taught on the basic of antenna. The versatility of Maxwell equations to solve numerous antenna problems is to be well elaborated.

Objectives

1. Define and explain what an antenna is;
2. Explain different types of antennae;
3. Differentiate between wired and non-wired antenna;
4. Analyse different wave equation; and
5. Employ Maxwell Equations in solving typical antenna problems.

Learning Outcomes

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

1. Describe the fundamental principles of antenna radiation;
2. Identify the different types of antennas used in communication;
3. Define the basic parameters of an antenna;
4. Illustrate the application areas of antenna in communication engineering;
5. Give examples of propagation models; and
6. Calculate the Link Budget and Path loss of a communication system.

Course Contents

Antenna Systems: Review of Maxwell's equations. Polarization, polar diagrams, antenna gain, directivity, radiation resistance, impedance matching, effective length and capture

area. Radiation by dynamic currents and charges, retarded potentials, the isotropic. Hertzian dipole, short and loop antenna, folded dipole antenna. Vertical and horizontal antennas, rhombic antenna, log-periodic antenna. Centre-fed linear antenna, linear arrays, radiation from diffraction gratings, Yagi-Uda arrays, integrated antennas. Microwave antenna, horn, parabolic reflectors, slot, and lenses. Field analysis of antennas. Transmitting-receiving system, reciprocity relations. Equivalent circuit of receiving antenna. Radar Systems: Principles of pulse radar and Doppler radar. Radar equation and system parameters. Components of radar systems. Study of a practical radar system. Radar signal detection. Synthetic aperture radar, tracking and scanning radar, HF (OTR) radar. Radio Wave Propagation: Electromagnetic waves, wave front, characteristic impedance of free space, reflection, refraction and diffraction. Ground waves and sky waves. The ionospheric layers, refractive index, virtual height, critical frequency and angle, maximum usable frequency, skip zone, skip distance, fading. VHF line of sight transmission. Tropospheric scattering communications. Relationship between transmitter power, antenna gains and received signal to noise in a free space radio link. VHF and microwave point-to-point link.

SUMAS EEE 512: Information Theory and Coding

(2 Units, E, LH: 30)

Senate Approved Relevance

This course will aid in the production of top-notch graduates who are highly skilled in the design and analysis of communication channels, modulation, error control coding, mathematical treatment of the concepts, parameters, and rules governing the transmission of messages that improve wireless communication system, thereby contributing to the development of a more fulfilling life and environment for the benefit of mankind, in Nigeria and the rest of the world, which is of great importance. This is required to create excellent communication engineers who can act as role models and are self-sufficient and knowledgeable about the fundamental ideas and technical principles that underpin current technological advancements. They must also possess entrepreneurial skills and a sense of social responsibility so that they can handle both domestic and global issues in communication engineering. The course's emphasis on statistics and probability is also crucial in preparing the students with analytical and critical thinking skills for current and upcoming tasks.

Course Overview

In order to make decisions, statistics involves gathering, organizing, analyzing, and interpreting data. In communication engineering and other relevant engineering domains, statistics is a

crucial instrument for robust analysis, measurement systems, error analysis, test data analysis, probabilistic risk assessment, etc. With the construction of both source codes and error-detection/-correction codes, the course will give the students a fundamental understanding of the nature of information, the effects of noise in analogue and digital transmission systems, and how to use them. It is mostly based on probability theory and statistics. The amount of information about distributions related to random variables is often covered. The two major measurements of information are entropy (a measure of information in one random variable) and mutual information (a measure of information shared by two arbitrary variables). A characteristic of the overall distribution of two arbitrary variables is the first quantity. When the channel statistics are established by the collective or joint distribution, it is the highest rate of ideal communication via a noisy channel in the long block length limit. These aid in the proper design of communication systems with improved service quality.

Objectives

The objectives of the course are to:

1. Describe fundamental concept of entropy and information as they are used in communications;
2. Understand probabilities, entropy, measures of information;
3. Explain the implications and consequences of fundamental theories and laws of information theory and coding theory with reference to the application in modern communication and computer systems;
4. Calculate the information content of a random variable from its probability distribution with conditional and marginal entropies of variables in terms of their coupled probabilities;
5. Define channel capacities and properties using Shannon's Theorems;
6. Construct efficient codes for data on imperfect communication channels;
7. Generalize the discrete concepts to continuous signals on continuous channels;
8. Understand Fourier Transforms and the main ideas of efficient algorithms for them; and
9. Describe the information resolution and compression properties of wavelets

Learning Outcomes

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

1. Know the Statistical characterization of noise and communication channels;
2. Explain Shannon theorem and Performance of communication systems;

3. Distinguish between entropy, information rate and channel capacity;
4. State the importance of security and different type of security technique in wireless communication;
5. Explain the basic features of Trading of bandwidth and S/N ratio; and
6. Understand and apply Correlation and power spectral density in modelling of communication system.

Course Contents

Review of probability theory and statistics. Introduction to stochastic processes; Correlation and power spectral density. Statistical characterization of noise and communication channels. Performance of communication systems (AM, FM, digital) in the presence of noise. Measure of information, entropy, information rate and channel capacity. Shannon theorem, source and channel coding. Error control coding. Trading of bandwidth and S/N ratio.

SUMAS EEE 514: Introduction to Robotic and Automation Engineering (2 Units, E, LH: 30)

Senate Approved Relevance:

This course will aid in the development of knowledge, abilities, and transferable skills, such as those required in robotics, automation, and machine learning, so that graduates will be prepared to start their own businesses, work as professional engineers, advance to the level of registered engineer, or pursue a variety of other careers. This is consistent with SUMAS vision and mission.

Course Overview:

Robotic and Automation are the emerging technology in modern world. This course covers introduction to automation, Programmable Logic Controllers, CNC Machines, Computer assisted part programming, Automatically Programmed Tools (APT Programming System), CAD/CAM approach to part programming, CAD/CAM application (turning problem, surface milling, machining of curved surfaces).

Objectives:

The objectives of the course are to:

1. Introduce student to economics of automation, flow lines, mathematical models, storage buffers, partial automation, balancing, group technology and flexible manufacturing. programmable logic controllers;

2. Introduce students to plc programming, structured text programming, instruction list programming, function block programming, continuous control, plc data communication, and human machine interfaces (HMI);
3. Introduce students to relevant components and building blocks for embedded solutions;
4. Introduce students to basic knowledge of programmable logic controllers;
5. Enable students to understand and design cases (dead-man switches, conveyor, accept/reject sorting);
6. Enable students to understanding of human machine interfaces (HMI); and
7. Enable students to understanding CAD/CAM approach to part programming.

Learning Outcomes

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

1. Analyse and explain the basic building blocks of automation;
2. Understand PLC Programming, Structured text programming, Instruction list programming, Function block programming, Continuous control, PLC data communication, Human Machine Interfaces (HMI), Selecting a PLC relevant components and building blocks for embedded solutions;
3. Have basic knowledge of Programmable Logic Controllers;
4. Understand and design Cases (Deadman Switches, Conveyor, Accept/Reject Sorting); and
5. Have details understanding of Human Machine Interfaces (HMI).

Course Contents

Introduction to automation: Economics of Automation, Flow Lines, Mathematical Models, Storage Buffers, Partial Automation, Balancing, Group Technology and Flexible Manufacturing. Programmable Logic Controllers: Introduction to PLCs, Advantages of PLCs, Ladder Logic Diagrams, Switching Logic. Components of PLC, PLC Operating Cycle, Additional Capabilities of a PLC, Latches, Design Cases (Deadman Switches, Conveyor, Accept/Reject Sorting), Addressing. PLC connection, PLC operation, Numbering, Event based logic, sequential logic design, Advanced ladder logic functions. PLC Programming, Structured text programming, Instruction list programming, Function block programming, Continuous control, PLC data communication, Human Machine Interfaces (HMI), Selecting a PLC. CNC Machines: General information, Operation, Control panel descriptions, Tool function, Practical application of tool wear offset, feed function, spindle function, programming of CNC in absolute and incremental systems, program creation, preparatory functions, CNC Programming, Computer assisted part programming, Automatically programmed tools (APT Programming System), CAD/CAM

approach to part programming, CAD/CAM application (turning problem, surface milling, machining of curved surfaces).

SUMAS EEE 522: ADVANCE ELECTRICAL MACHINE AND DRIVE: (2 units, E, LH: 30)

Senate Approved Relevance:

In order to forecast the behaviors of spinning AC electrical machines at any moment in time, it is crucial to understand both their steady state and dynamic behaviors, and to do this, the right machine model must be used. In-depth modeling of an AC electrical machine will be covered in this course, along with an analysis of both steady state and dynamic behavior. Students who complete this course will be equipped to examine any AC electrical machine and support the design of electrical machines. After completing the program, the course's materials will have equipped the students to operate effectively and efficiently in the analysis of AC electrical machines, the backbone of the manufacturing sector. This is very relevant to the development of our region.

Course Overview:

In order to accurately forecast how electrical machines will behave at any given time, it is crucial to analyze how they operate under steady state and dynamic settings. The general theory of machines must be fully understood in order to perform steady state and dynamic analysis of any spinning electrical machine. The general theory of machines is initially covered with transformation in this course. After that, rotating electrical AC machines are modeled using the general theory to provide analogous circuits. After that, the machines are examined for both little and significant disturbances such load changes and three-phase short circuits. For wound rotor induction machines, the effect of rotor resistance is taken into account.

Objectives

The objectives of this course are to

1. Provides a thorough basis for electrical machines study at advanced level;
2. Model the different types of machines of Electrical AC machines: induction and synchronous machines using the general theory of machines;
3. Apply transformation to polyphase induction and synchronous machines;
4. Carry out steady state and dynamic analysis of polyphase induction and synchronous machines;
5. Examine the transient operation of synchronous machine when it experiences small and large disturbances such as three phase short circuit at its terminals;

6. Describe Electrical Machines in the modern world and in the context of the electrification revolution;
7. Apply mathematics to formulate solutions to solve problems in solving electrical system problems; and
8. Use advanced AC circuit theory to analyse electrical machines

Learning Outcomes:

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

1. Develop and use the machine general model;
2. Develop and use machine equivalent circuits to obtain speed, torque and efficiency characteristics;
3. Explain and model the transient analysis of poly-phase induction motors and synchronous machines;
4. Examine the synchronous machine transients;
5. Explain the induction machine dynamics and transients;
6. Analyze the performance induction machine during sudden changes in load and three phase fault; and
7. Explain the models for dynamic analysis of induction machines.

Course Contents:

Transient and steady analysis of poly-phase induction motors, equivalent circuits, characteristics and speed control. Synchronous machine: steady state analysis, saliency and d-q axis analysis, Matrices equations. Synchronous machines transients: Sudden 3-phase short circuit, transformation to d axis and q axis, operational circuit impedance and time constant, model for transient analysis. Synchronous phenomena and sustained oscillators in synchronous machines. Induction machine dynamics and transients: performance during both sudden changes in load and 3-phase fault, models for dynamic analysis, effect of rotor resistance.

SUMAS EEE 524: POWER SYSTEM COMMUNICATION AND CONTROL (2 units, E, LH:30)

Senate Approved Relevance

The course will help the student to develop knowledge, skills including transferrable skills such as power system operation, planning, and maintenance as well as awareness and technical-know-how in the field of power system engineering and its related disciplines so that our graduate will self-employed and be employed as professional engineers progressing on to registered engineer or a wide range of other careers. This is in line with the vision and mission of SUMAS.

Course Overview

Power System Control and Stability is the ability of the system to return to equilibrium after a sustained disturbance. It involves the control and stability of industrial generation of regulated output Voltage. The students will be furnished with tactics involve in stabilizing a disturbed system in term of machine governor control, tap-changing, voltage regulator and the likes.

Objectives

The objectives of the course are to:

1. Define power generation;
2. Discuss the control of power generation;
3. Discuss the various voltage control methods in power system;
4. Explain the concept of power system stability and analysis;
5. Describe the workings of automatic voltage regulators;
6. Describe the workings the regulating transformers; and
7. Discuss the systems faults analysis.

Learning Outcomes

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

1. Describe the control of power generation in power system;
2. Discuss the various voltage control methods in power system;
3. Explain the concept of power system stability and analysis;
4. Describe the principle of automatic voltage regular and regulating transformer; and
5. Explain and analyze faults in power system.

Course Contents

Review of transmission line theory. High frequency communication on power lines carrier systems and power line carrier applications. Multiplexing, Telemetry, Signal processing and data transmission. Control of power generation, voltage control, system stability, and automatic voltage regulators, regulating transformers.

SUMAS EEE 526: COMPUTER APLLICATION IN POWER SYSTEMS (2 units, E, LH: 30)

Senate Approved Relevance

High-quality graduates with advanced computer and software skills can receive training to assess and resolve power system-related issues. This could make a big contribution to the improvement of humankind's quality of life and environment. This is required to create excellent, self-sufficient electrical engineers who can serve as role models and who possess the necessary

technical knowledge, business acumen, sense of civic responsibility, communication skills, and management abilities to deal with domestic and global issues in electrical engineering related to sustainable power generation, transmission, and distribution systems.

Overview

Power System computer applications are crucial for assessing system performance and real-time monitoring systems. To track real-time electrical transition, the majority of the electrical system makes use of a variety of software. Smart computers are used in electrical engineering to control and monitor power distribution, diverting a load of electricity consumption from heavy demand to prevent blackouts in the electricity system. Computers are essential to the operation and efficient operation of many electrical items. The power system applications of MATLAB/SIMULINK, iterative load flow problem solving methods, and state estimation are the main topics of this course.

Objectives

The objectives of the course are to:

1. List and discuss various linear algebra and numerical methods;
2. Explain state estimation in power system;
3. Define load forecasting;
4. State different types of load forecasting methods and explain the differences between them;
5. Understand what Von Karman filter is and its application in power system;
6. Explain what MATLAB is and its various applications; and
7. Use MATLAB to solve power system problems.

Learning Outcome

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

1. Use linear algebra and numerical methods to solve problems in power system;
2. Apply iterative methods like Newton-Raphson, Gauss elimination, Gauss Seidel etc to solve non-linear problems in power system;
3. Formulate and develop algorithm for node admittance and Z-Bus matrices in power system;
4. Solve problems related to state estimation, load forecasting and time series in power system;
5. Understand the step by step methods of load flow analysis for transmission and distribution systems and write MATLAB codes for load flow; and

6. Use MATLAB/SIMULINK for analysing performances of power systems.

Course Contents

Revision of linear algebra and numerical methods. Iterative method. Newton-Raphson methods. Gauss elimination method, Gauss-Siedel method. Euler method, Runge-Kutta 4th order method. Node admittance matrix. Load flow analysis. State estimation. Load forecasting technique. Time series, Von Karman filter. MATLAB applications in power system.

SUMAS EEE 528: Power System Economics and Operations (2units, E, LH:30)

Senate Approve Relevance

The introduction of competition in electricity generation and retail has altered how power systems operate. Power systems operations and the underlying economics of a competitive market must be thoroughly understood in order to build and operate successfully. Therefore, this course become important for the young Engineer in order to be firm in the competitive energy markets.

Course Overview

This course introduces fundamental ideas related to the design, analysis, economics, and management of contemporary electrical power systems. It also discusses how to approach interdisciplinary problems, introduces grid user classification, load control, and tariffs, and raises awareness of the operational technical issues that arise with such systems.

Objectives

The objectives of this course are to

1. State elements of control of power systems;
2. Discuss economic and management aspect;
3. Describe the advanced concepts of operation of electrical power;
4. Describe the economic operation of generating plants,
5. State the effect of transmission on economy of systems.

Learning Outcomes

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

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

5. Appreciate the important energy policy issues.

Course Contents

This course explores the theoretical and empirical perspectives on individual and industrial demand for energy, energy supply, energy markets, and public policies affecting energy markets. It discusses aspects of the oil, natural gas, electricity, and nuclear power sectors and examines energy tax, price regulation, deregulation, energy efficiency and policies for controlling emission. Principles and operations of power generating systems; components of power generating systems, types of stations, Design and organization of voltage and frequency controls, Load curve studies, Economic principles, cost equations, economic operation of generating plants, effect of transmission on economy of systems. Electrical load development, tariff, load duration curves; effect of power factor on plant.

SUMAS EEE 532: NUMERICAL METHODS (2 Units; E, LH:30)

Senate Approval Relevance

Numerical methods become handy in control engineering when analytical solution becomes difficult in solving system equations like those found in circuit analyses. The course is very useful in filter designs, control theory, electrical circuit analyses, and curve fittings. It is applied to numerical solutions of differential equations and used to simulate device such as semiconductors and antenna. In line with SUMAS mission and vision, students upon their graduation will be seen as design engineers who are able to participate actively in the engineering processes and are capable to translate their knowledge into practical and meaningful products. Whether the goal is integration or solution of complex differential equations, there are many tools available to reduce the solution of what can be sometimes difficult to simple algebra.

Overview

The course deals with methods of solving multidimensional problems like in temperature fields. It is an extension of ordinary differential equation (ODE) and partial differential equation (PDE) used as approximate computer method for solving a mathematical problem which often has no analytical solution. Critical study and demonstration of various theorems and methods applied in numerical methods like analyses of polynomials, iterative processes will be explored in details, in addition to the use of mathematical software to resolve complex problems. The procedure uses an initial value to generate a sequence of improving approximate solutions for a class of problems, in which the n -th approximation is derived from the previous ones.

Objectives

The Objectives of the Course are to;

1. Explain polynomial and their zeros – method of bisection, Newton Raphson method, Bairstow
2. Explain direct methods for the solution of linear equations; Iterative process, its application to the solution of simultaneous linear equation, Jacobi method, Gauss-Seidel method
3. Understand Interpolation- Lagrange interpolation
4. Understand Numerical differentiation – Forward difference, central difference and backward difference.
5. Understand how to use Mat Lab to solve numerical analysis

Learning Outcomes

On completion of the course, students are expected to;

1. Explain polynomial and their zeros – method of bisection, Newton Raphson method, Bairstow.
2. Explain direct methods for the solution of linear equations; Iterative process, its application to the solution of simultaneous linear equation, Jacobi method, Gauss-Seidel method
3. Understand solving Interpolation- Lagrange interpolation
4. Understand solving Numerical differentiation – Forward difference, central difference and backward difference.
5. Understand how to use MATLAB to solve numerical analysis

Course Contents

Polynomial and their zeros. Method of bisection. Newton Raphson method. Bairstow. Synthetic division and Lehmer. Direct methods for the solution of linear equations. Iterative process. Its application to the solution of simultaneous linear equation. Convergence. Jacobi method. Gauss-Seidel method. Newton Coates formulae and finite difference methods. Eigen system problem. Solution of ordinary differential equation. Methods of Taylor. Euler. Predictor. Corrector and Runge-Kutta. Interpolation. Lagrange interpolation. Numerical integration. Forward difference. Central difference. Backward difference. How to use MATLAB to solve numerical analysis.

Minimum Academic Standard: As per CCMAS

SUMAS EEE 534: MEASUREMENT AND INSTRUMENTATION (2 Units, E, LH: 30)

Senate Approval Relevance

Most appliances and machines requires electricity to operate, however there is need to ensure that they are working appropriately and accurately, hence the relevance of Measurement and Instrumentation as course in electrical and electronic engineering. Students will be exposed to the use of instruments for measurements and be able to calibrate to match the readings of a particular standards with good potential to provide accurate and reliable results. The students also in line SUMAS vision and mission, will be able to exercise their original thoughts on measurements, have good professional judgement of their working environment, and take responsibility for the direction of important task.

Overview

The course will describe in details the methods, devices, and calculation used to measure electrical quantities. With the use of transducers, physical properties such as temperature, pressure, flow, force, and many others that can be converted into electrical signals, which can then be conveniently measured and recorded. The study approach will involve classical organization of electronic components to form systems and subsystems which eventually turns out to be instruments being applied in the field of Engineering.

Objectives

The objectives of the Course are to;

1. Describe measuring instruments
2. Analyse the quantities involved in measuring instruments
3. Analyse the principles and operations of measuring instruments
4. Analyse the advantage and disadvantages of each of them
5. Describe the errors encountered in measuring instrument operations

Learning Outcomes

On completion of the course, students are expected to;

1. Explain the classification of measuring instruments.
2. Explain the rudiments of quantities, types and units of measurement
3. Describe the principles that guide the system of operation of instruments
4. Analyse the rudiments of operation and guiding principles
5. Explain the advantages of certain instruments over the others
6. Explain the precautions being taken in design of instruments.

7. Describe the design measuring instruments.
8. Explain the concept of error in measuring instruments and how to minimize them

Course Contents

General instrumentation. Basic meter in DC measurement. Basic meter in AC measurement. Rectifier voltmeter. Electro-dynamometer and wattmeter. Instrument transformers. DC and AC bridges and their applications. General form of AC Bridge. Universal Impedance Bridge. Electronic instrument for measurement of voltage. Current. Resistance. Circuit parameters. Electronic voltmeter. AC voltmeters using rectifiers. Electronic multimeters digital voltmeters. Oscilloscope. Vertical deflection system. Horizontal deflection systems. Probes. Sampling CRO. Instruments for generating and analysing waveforms. Square wave and pulse generator. Signal generators. Function generators. Wave analysers. Electronic counters and their applications. Time base circuitry. Universal counter measurement modes. Analog and digital data acquisition systems. Tape recorders. Digital-to-Analogue and Analogue-to-Digital conversions. Sample and hold circuits.

Minimum Academic Standard: As per CCMAS.

SUMAS EEE 536: SOFTWARE DEVELOPMENT TECHNIQUES (2 Units, E, LH: 30)

Senate Approved Relevance

The world is increasing faster in technological advancement especially in areas of software development techniques and with the current trend in technological advancement, any institution that did not meet up with the demands in the software development is regarded as non-growing university. State University of Medical and Applied Sciences (SUMAS), Igbo-Eno, Enugu State will not be left out in this growth in the software development. Therefore, the relevance of the course is seen in the electrical and electronic engineering lecturers from SUMAS being able to study the software development life cycle, solve practical engineering problems using pseudo-code/flowchart, write a structured programming language using C-language, deploy the top down design method in development of programmes, identify the debugging and documentation techniques, determine the 1-D, and multi-dimensional arrays passing elements or whole array to functions. It is expected that the graduates from SUMAS who undergone through the courses according to SUMAS will always be in the front line in terms of teaching, learning and research.

Overview

Software development techniques are the concepts and processes that engineers use to structure software development projects. This course will study the software development life cycle. It

will solve practical engineering problems using pseudo-code/flowchart. It will further develop a structured programming language using C-language, deploy the top down design method in development of programmes. It will identify the debugging and documentation techniques, and further determine the 1-D, and multi-dimensional arrays passing elements or whole array to functions.

Objectives

The objectives of the course are to make students to:

- (1) Study the software development life cycle
- (2) Have an indebt knowledge of writing pseudo-code and using it to solve practical engineering problems using pseudo-code/flowchart
- (3) Write a structured programming language using C-language
- (4) Deploy the top down design method in development of programmes
- (5) Identify the debugging and documentation techniques
- (6) Determine the 1-D, and multi-dimensional arrays passing elements or whole array to functions
- (7) Identify command line parameters
- (8) Create header files

Learning Outcomes.

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

1. Review software development life cycle
2. Solve practical engineering problems using pseudo-code/flowchart
3. Write a structured programming language using C-language
4. Deploy the top down design method in development of C- programmes
5. Identify the debugging and documentation techniques
6. Determine the 1-D, and multi-dimensional arrays passing elements or whole array to functions
7. Identify command line parameters
8. Create header files

Course Contents

Software Development life cycle. Top-Down design. Program, design using pseudo-code, flowchart ANSI symbols and usage. Extensive examples, and exercises using pseudo-code/flowchart to solve practical problems engineering. Debugging and documentation techniques. Programming using a structural language such as C: symbols, keywords, identifiers,

data types, operators, various statements, operator precedence, type conversion, conditional and control structures, function, recursive functions. Arrays: 1-D, and multi-dimensional arrays passing elements or whole array to function. Simple sorting and searching on arrays, pointers, strings, dynamic memory allocation. Structures and unions: structures declaration and identification, accessing structures, array of structures, pointers and structures, union declaration, enumerated variables. File handling: concept of a file, files and streams, standard file handling functions, binary files, random access files. Advanced topics: command line parameters, pointers to functions, creation of header files, stacks, linked lists bitwise manipulation. Software development in C in MS windows, UNIX/LINUX environments, header file, pre-processor directives, make, make file. Static and dynamic linking libraries. Extensive examples, and exercises programming in C to solve practical problems in engineering. Exercises are to be done in the computer laboratory.

Minimum Academic standards: As contained in CCMAS

**SUMAS EEE 538: ADVANCED MICROPROCESSOR & MICRO-CONTROLLER SYSTEM
(2Units;E;LH;30)**

Senate Approved Relevance

As technology advances, many companies continue to have a high demand for employees with in-depth knowledge of advanced microprocessor and microcontroller system. A common classification among many control systems is microprocessor and microcontroller system. As a control engineer, understanding microprocessor and microcontroller system can help you create and maintain control systems using various microprocessor and microcontroller system and this will result in much financial gain. The relevance of the course is seen in Electrical and Electronic lecturers from SUMAS being able to teach the student the concepts of microprocessor and microcontroller system, architecture and interfacing, digital signal processing, microprocessor architecture and programming and Microcontroller system, Intel 8051/8031 Micro-controller architecture, interfacing and programming; Motorola M6812 microcontroller architecture, interfacing and programming, introduction to PIC microcontroller: general architecture, applications. It is expected that the graduates from Electrical and Electronic option from SUMAS who undergone through the courses according to SUMAS vision and mission will always be in the front line in terms of teaching, learning and research.

Overview

Microcontrollers and microprocessors are different ways of organizing and optimizing a computing system based on a CPU. While a microcontroller puts the CPU and all peripherals onto the same chip, a microprocessor houses a more powerful CPU on a single chip that connects to external peripherals. Microprocessor is used in Personal Computers whereas Micro Controller is used in an embedded system.

The objectives of the course are to make students to:

1. Equip themselves with the concepts of advanced microprocessor and microcontroller system
2. Learn the architecture and interfacing of microprocessor and microcontroller system
3. Understand digital signal processing,
4. Understand microprocessor architecture and programming
5. learn Microcontroller system, Intel 8051/8031 Micro-controller architecture,
6. Understand interfacing and programming; Motorola M6812 microcontroller architecture, interfacing and programming,
7. Discuss introduction to PIC microcontroller: general architecture, applications.

Learning Outcomes

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

1. Equip themselves with the concepts of advanced microprocessor and microcontroller system
2. Learn the architecture and interfacing of microprocessor and microcontroller system
3. Understand digital signal processing,
4. Understand microprocessor architecture and programming
5. learn Microcontroller system, Intel 8051/8031 Micro-controller architecture,
6. Understand interfacing and programming; Motorola M6812 microcontroller architecture, interfacing and programming,
7. Discuss introduction to PIC microcontroller: general architecture, applications.

Course Content

Introduction to superscalar processor, parallel processor. High performance RISC microprocessor Architecture and interfacing e.g. Intel i960, and Motorola PowerPC microprocessor. Digital signal processing microprocessor architecture and programming. Microcontroller system: Intel 8051/8031 Micro-controller architecture, interfacing and

programming; Motorola M6812 microcontroller architecture, interfacing and programming. Introduction to PIC microcontroller: general architecture, applications and selection of microcontroller, advantages, low-end, and high-performance PIC. Specific PIC microcontrollers: Features, architecture, block diagram, pin configuration, on-chip memory, and peripheral. Instruction set and Assembly language programming. Serial I/O interfacing: 12C, and SPI interfacing and programming. Memory interfacing: external memory interfacing, EEPROM and Flash memory interfacing. Design exercises using development system.

Minimum Academic standards: As contained in CCMAS

List of Laboratories

Control and Instrumentation Laboratory

Electronics Laboratory

Microprocessor and Digital System Laboratory

Computer Engineering Laboratory (Hardware and Software)

Communication Laboratory

Energy Laboratory

Electric Power/Machine Laboratory

Equipment's

Digital logic analyser

Smart Logic Design Experimental Kit

Digital Logic Circuit Design Experiment Kit Microcomputer Trainer

AM/FM Transmitters and Receivers System Trainer

Fiber-optic Transmission Training System

GSM/GPS Experimental Trainer

Programmable Logic Controller System Trainer

Digital 3 Phase Power Analyzer with SD Card Real time data Recorder

Digital Storage Colour Display 2/4-Channel Oscilloscope

Arbitrary waveform and Digital Synthesized Function Generator

Digital spectrum Analyser (9kHz -3GHz)

Instrumentation Trainer using Transducers Complete Set

Digital Communication System Trainer

Analog Communication System Trainer

Solar Power System Training kit

Electrical and Electronic System Trainer

Single Phase Transformer System Trainer
3- Phase Transformer System Trainer
Power Electronic Training System
Colour TV Trainer
Programmable Dual output DC Power Supply Units (different ranges)
Variable Transformer
PA (Public Address) System Trainer
Portable Wind Power Generator Training Kit Universal EPROM Programmable (48 Pins)
Bench Digital Multi-metre digit (various digit ranges)
High voltage Insulation tester variable digital type up to 10kV Power factor meter
Frequency metre
Digital energy metre
Digital watt metre, single phase
Digital watt meter, 3-phase
Semi-conductor curve tracer
Advanced frequency modulation and demodulation trainer
Digital transistor tester
Decade resistance box
Decade capacitance box
Decade inductance box
3-phase variable inductance load
3-phase variable capacitance load
3-phase variable resistance load
Digital multifunction documenting calibrators
Digital function generator (different frequency ranges)
Electrical Tools Box
Digital Stroboscope
Digital DC A ammeters multi-range
Digital AC Volt meters Multi range
Digital DC Volt meters Multi range
Digital DC Volt meters Multi range
Digital Damp meter
Standard Digital Earth Loop/PSC/Tester

Photo/contact Tachometer
LCD Display 3-Phase Rotation Tester
Rheostat (different ranges)
Wheatstone bridge
Portable DC Potentiometer
Analogue dual-trace Oscilloscopes (different frequency ranges)
Signal Trace/injector
Digital RF Signal Generators
Klystron Microwave Trainer complete set
Antenna Lab Trainer complete set
PCB Fabrication Equipment complete set
Standard Analogue Multimeters
AVO meters
Electric power transmission training kit

Staffing

Academic Staff

The NUC guidelines on staff/student ratio of 1:15 for Engineering and Technology departments shall apply. However, there should be a minimum of six full-time equivalents of Staff in the department. There is need to have a reasonable number of Staff with doctoral degrees as well as sufficient industrial experience. With a minimum load of 15 Units per semester for students and a minimum of six full-time equivalents of staff in each programme, staff should have a maximum of 15 contact hours per week for lectures, tutorials, practicals and supervision of projects.

NUC requirement encourages all academic staff to have PhD degrees; hence appointment of academic staff is preferably to the Lecturer cadre. Only in exceptional cases are candidates with great promise appointed to Graduate Assistant and Assistant Lecturer positions for the purpose of being developed to the Lecturer cadre as registered PhD candidates.

Academic Support Personnel

Teaching Assistant/Demonstrators to help lecturers in the conduct of tutorials, practicals and field work. This category of personnel is not expected to be regular staff as they are to be paid on the basis of approved hourly rate.

Administrative Support Staff

The services of the administrative support staff are indispensable in the proper administration of the departments and faculty offices. It is important to recruit very competent senior staff that is computer literate.

Technical Support Personnel

The services of technical support staff, which are indispensable in the proper running of laboratories and workshop/studios, are required. It is important to recruit very competent senior technical staff to maintain teaching and research equipment. They are also to undergo regular training to keep them abreast of developments in equipment operation and maintenance. The minimum of academic staff to technical staff ratio of 5:1 should be maintained.

Minimum Number of Staff

Subject to the general standards specified by NUC:

1. There should be a minimum of two PhDs and four M.Eng degree holders full-time academic staff to mount the programme;
2. Each workshop or laboratory should have an adequate number of staff with the right mix, such that each unit or section in that workshop or laboratory can run efficiently; and
3. There should be an adequate number of administrative staff of the appropriate caliber for the office of the Head of Department to run.

Student/Staff Ratio

The minimum staff-to-student ratio should be 1:15 from 200 level to 500 level.

Library

In addition to the university and faculty libraries, the programme must have a departmental library that is well equipped with specialized books and journals in both physical collections and E-collections (E-Resources) of various types. Various field and research reports of the programme must also be available in the library for staff, students and researchers.

The library must be connected to subscribe repository of:

1. Institutions (national and international)
2. Open access sources
3. Professional Bodies' e-learning platforms
4. Relevant international organizations

The library must also have adequate facilities for the following:

1. Reading
2. Provisions for lending
3. Reservation unit for specialized materials.

Classrooms, Laboratories, Workshops, Clinics and Offices

NUC recommended minimum physical space requirements are provided in the Table below:

Academic and Non-Academic Spaces

The NUC recommends the following physical space requirement:

Academic	m²
Dean's office	18.50
Professor's Office	18.50
Head of Department's Office	18.50
Tutorial teaching staff space	13.00
Other teaching staff space	17.00
Technical Staff space	17.00
Science Staff Research Laboratory	16.50
Engineering Staff Research Laboratory	14.50
Seminar Space per student	1.85
Drawing Office Space (A.O. Board) (Per Student)	4.60
Drawing Office Space (A.I. Board) (Per Student)	3.70
Laboratory Space	7.50
Secretarial Space	7.00

Office Facilities

S/no	Office	No. in room	Facilities
1	HOD	1	Table, chairs, A/C, filing cabinet, bookshelves, computer unit, secretary and facilities
2	Professor	1	Table, chairs, A/C, filing cabinet, bookshelves, computer unit, secretary and facilities
3	Reader	1	Table, chairs, A/C, filing cabinet, bookshelves, computer unit.

4	Senior lecturer	1	Table, chairs, A/C, filing cabinet, bookshelves, computer unit.
5	Lecturer 1	2	Table, chairs, fan, filing cabinet, bookshelves
6	Lecturer II	3	Table, chairs, fan, filing cabinet, bookshelves