Enugu State University of Science and Technology, Enugu

Faculty of Engineering

Department of Electrical and Electronic Engineering

Program Educational Objectives (PEOs), Program Objectives (POs) and Course Learning Outcomes (CLOs)

A. PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

Programme Educational Objectives (PEOs) of Electrical and Electronic Engineering of Enugu state university of science and technology is published in the departmental handbook and disseminated through faculty/departmental meetings, student awareness workshops, student orientation program, placement and training activities and relevant social media at regular intervals. Other documents disseminated the same way include; Vision, Mission, motto, aim, objectives and Pos with the aim of producing graduates that are conscious of their environment and have acquired the requisite knowledge, skills and emotional disposition needed for the ever-growing world of technology. These documents are also made available to the stakeholders of the program.

The general goals and objectives of the Departmental programme align with the realization of national needs and aspirations vis-à-vis industrial development and technological emancipation. The graduates are therefore resourceful, creative, knowledgeable as they are being trained based on the following PEOs of the Department;

1. **PEO1**: To provide adequate training and groom research-orientated students in Electrical and Electronic engineering to fill in the gap between advances in technology and current knowledge in the application of appropriate strategies in solving problems.

2. **PEO2**: To produce highly skilled graduates with high academic and leadership standard as well as adequate practical backgrounds that will utilize Electrical and Electronic Engineering knowledge in providing the needed skills for self-employment as well as being of immediate value to industry and the community in general.

3. **PEO3**: To develop a thorough practice in Engineering and Technology training thereby, producing high-quality graduates who can deploy practical knowledge into Electrical and Electronics, Telecommunication Engineering, and Manufacturing processes and cope, compete with the global technological trend.

These PEOs are designed to align with the vision and mission of the university and focus on developing well-rounded, skilled graduates who can contribute effectively to their field and society as a whole.

1. **PEO1**: To provide adequate training and groom research-orientated students in Electrical and Electronic engineering to fill in the gap between advances in technology and current knowledge in the application of appropriate strategies in solving problems, *which is in line with the ESUT vision to promote services to humanity through quality research and to ESUT mission to promote scholarship, especially in the areas of science and technology.*
2. **PEO2**: To produce highly skilled graduates with high academic and leadership standard as well as adequate practical backgrounds that will utilize Electrical and Electronic Engineering knowledge in providing the needed skills for self-employment as well as being of immediate value to industry and the community in general, *which is in line with ESUT's mission towards developing quality manpower for community development, promote scholarship, especially in the areas of Science, Management, and Technology and to its vision of being premier university in Africa in capacity development that promotes services to society through quality teaching, research, and community service.*

3. **PEO3**: To develop a thorough practice in Engineering and Technology training thereby, producing high-quality graduates who can deploy practical knowledge into Electrical and Electronics, Telecommunication Engineering, and Manufacturing processes and cope, compete with the global technological trend, *which is in line with the ESUT's mission of training graduates who can favorably compete with their counterparts globally and promote scholarship, especially in the areas of science and technology. This is in line with ESUT's mission towards developing quality manpower for community development and to its vision of being premier university in Africa in capacity development.*

B. **PROGRAMME OUTCOMES (POS)**

POs as defined by COREN

1. **COREN-PO1: Engineering Knowledge**: apply knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of developmental and complex engineering problems;
2. **COREN-PO2: Problem Analysis:** Identify, formulate, research literature and analyse developmental and complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences;
3. **COREN-PO3: Design/Development of Solutions**: Proffer solutions for developmental or complex engineering problems and design systems, components or processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal and environmental considerations;
4. **COREN-PO4: Investigation:** Conduct investigation into developmental or complex problems using research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of information to provide valid conclusions;
5. **COREN-PO5: Modern Tool Usage:** Create, select and apply appropriate techniques, resources and modern engineering and ICT tools, including prediction, modelling and optimization to developmental and complex engineering activities, with an understanding of the limitations
6. **COREN-PO6: The Engineer and Society:** Apply reasoning informed by contextual knowledge including humanities and social sciences to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to professional engineering practice
7. **COREN-PO7: Environment and Sustainability:** Understand the impact of professional engineering solutions in societal and environmental contexts and demonstrate knowledge of and need for sustainable development
8. **COREN-PO8: Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of engineering practice, including adherence to the COREN engineers' codes of conduct
9. **COREN-PO9: Individual and Team Work:** Function effectively as an individual, and as a member or leader in diverse teams and in multi-disciplinary settings
10. **COREN-PO10: Communication:** Communicate effectively on developmental or complex engineering activities with the engineering community and with society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions;
11. **COREN-PO11: Project Management:** Demonstrate knowledge and understanding of engineering, management and financial principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multi-disciplinary environments demonstrate knowledge and understanding of engineering, management;
12. **COREN-PO12: Lifelong Learning:** Recognize the need for, and have the preparations and ability to engage in independent and lifelong learning in the broadest context of technological and social changes.

C. PROGRAMME OUTCOMES (POs) OF EEE DEPARTMENT

POs as defined by ESUT-EEE

1. **ESUT-EEE-PO1.** To be able to gather, organize and critically evaluate information needed to formulate and solve problems.
2. **ESUT-EEE-PO2.** To be able to appreciate a thorough understanding of the subject area as aligned with the current requirements of the professional institutions
3. **ESUT-EEE-PO3.** To be able to apply acquired knowledge effectively and efficiently to all work in the relevant areas of Engineering
4. **ESUT-EEE-PO4.** To be able to appreciate the requisite skills in oral and written communications, appropriate for the presentation of technical information at seminars and conferences
5. **ESUT-EEE-PO5.** To be able to appreciate the characteristic behavior of materials in electrical and electronic systems and adherence to standards
6. **ESUT-EEE-PO6.** To be able to analyze and design electrical and electronic systems from devices/components made of various materials
7. **ESUT-EEE-PO7.** To be able to understand the concepts of generation, transmission, and distribution of low and high-voltage power
8. **ESUT-EEE-PO8.** To be able to appreciate the cost-effectiveness and energy consumption of component/device equipment selection, manufacturing process, integration process and to function effectively as an engineer
9. **ESUT-EEE-PO9.** To be able to appreciate the range of manufacturing methods currently available and the skills which they require in people for their use
10. **ESUT-EEE-PO10.** To be able to understand the whole process of industrial decision-making in design, manufacturing, and use and how it is influenced not only by technical ideas but also by the practical constraints of financial and human resources and by the business and social environment of engineering
11. **ESUT-EEE-PO11.** To be able to improve on indigenous technology to enhance local problems solving capability
12. **ESUT-EEE-PO12.** To be able to observe, manage, design, and conduct experiments through practical experience in the laboratory

D. COURSE LEARNING OUTCOMES (CLOS)

100 Level Courses

GST 111: Communication in English

Catalog Description: This course improves students' English communication skills through speaking and writing exercises. It covers vocabulary, grammar, and intercultural communication for effective

rse Learning Outcomes (CLO): Upon successful completion of ourse, students will be able to:		**ssment Tools**
1. identify possible sound patterns in English Language	3,4	ework, Exam
2. list no table language skills;	4	ework, Quizzes, n
3. classify word formation processes;	3	ework, Quizzes, n
4. construct simple and fairly complex sentences in English;		ework, Quizzes, n
5. apply logical and critical reasoning skills for meaningful presentations;		ework, Quizzes, n
6. demonstrate an appreciable level of the art of public speaking and listening; and		ework, Quizzes, n

7. write simple and technical reports.		ıework, Quizzes, n

GST 112: Nigerian Peoples and Cultures

Catalog Description: This course explores Nigeria's diverse peoples, their traditions, and contemporary issues. Students gain an understanding of Nigeria's cultural heritage and the impact of globalization and modernization.

rse Learning Outcomes (CLO): Upon successful completion of ourse, students will be able to:		**ssment Tools**
1. analyze the historical foundation of Nigerian cultures and arts in pre-colonial times;	3	ıework, Exam
2. identify and list the major linguistic groups in Nigeria;	.1	ıework, Quizzes, n
3. explain the gradual evolution of Nigeria as a political entity;	.,	ıework, Quizzes, n
4. analyze the concepts of trade and economic self-reliance of Nigerian peoples in relation to national development;	4.11	ıework, Quizzes, n
5. enumerate the challenges of the Nigerian state regarding nation building;	3,11	ıework, Quizzes, n
6. analyze the role of the judiciary in upholding fundamental human rights		ıework, Quizzes, n
7. identify the acceptable norms and values of the major ethnic groups in Nigeria; and	4,11	ıework, Quizzes, n
8. list possible solutions to identifiable Nigerian environmental, moral and value problems.	4,11	ıework, Quizzes, n

GST 121: USE OF LIBRARY, STUDY SKILLS AND ICT

Catalog Description: This course teaches students how to use libraries effectively, develop study skills, and become proficient in information and communication technology. Students learn research techniques, critical thinking, time management, and ICT tools for academic success.

rse Learning Outcomes (CLO): Upon successful completion of ourse, students will be able to:		**ssment Tools**
1. Acquaint themselves with the parts of a book and the different types of libraries resources including the use of media resources	3, 4	ıework, Exam
2. Understand the purpose of the University Library, the kind of materials it acquires and their physical arrangement and organization.	3, 4	ıework, Quizzes, n
3. Have a general idea of classification systems used in libraries as God was the first classifier.	3, 4	ıework, Quizzes, n
4. Know or have knowledge of how to select books on their subject areas as well as spiritual growth	3, 4	ıework, Quizzes, n
5. Know how to use the card catalogue and ability to search for information beyond the catalogue e.g., internet search.	3, 4	
6. Familiarize them with the major reference books both general and specialized, what they are and	3, 4	ıework, Quizzes, n

7. Acquaint themselves with the parts of a book and the different types of libraries resources including the use of media resources	3, 4	

ICH 111: General Chemistry I

Catalog Description: General Chemistry I introduce students to foundational principles and concepts in chemistry. Topics include atomic structure, chemical bonding, and stoichiometry. Through lectures, labs, and problem-solving, students gain a strong understanding of chemical principles. The course emphasizes critical thinking, inquiry, and lab safety. Prepares students for further studies in chemistry.

rse Learning Outcomes (CLO): Upon successful completion of ourse, students will be able to:		**ssment Tools**
1. define atom, molecules and chemical reactions;		ework, Exam
2. discuss the modern electronic theory of atoms;	6	ework, Quizzes, n
3. write electronic configurations of elements on the periodic table;	6	ework, Quizzes, n
4. rationalize the trends of atomic radii, ionization energies, electronegativity of the elements, based on their position in the periodic table;	6	ework, Quizzes, n
5. identify and balance oxidation–reduction equation and solve redox titration problems;	6	ework, Quizzes, n
6. draw shapes of simple molecules and hybridized orbitals	6	ework, Quizzes, n
7. identify the characteristics of acids, bases and salts, and solve problems based on their quantitative relationship	6	ework, Quizzes, n
8. apply the principles of equilibrium to aqueous systems using LeChatelier's principle to predict the effect of concentration, pressure and temperature changes on equilibrium mixture	6	ework, Quizzes, n
9. analyze and perform calculations with the thermodynamic functions, enthalpy, entropy and free energy; and	6	ework, Quizzes, n
10. determine rates of reactions and its dependence on concentration, time and temperature.	6	ework, Quizzes, n

ICH 197: General Practical Chemistry I

Catalog Description: General Practical Chemistry I is a hands-on lab course that reinforces theoretical knowledge. Students perform experiments, learn measurement techniques, and practice qualitative analysis. Develops practical lab skills, critical thinking, and safety awareness. Enhances understanding and application of chemical principles in a laboratory context.

rse Learning Outcomes (CLO): Upon successful completion of ourse, students will be able to:		**ssment Tools**
1. state the general laboratory rules and safety procedures;	6,12	zes, Exam
2. collect scientific data and correct carry out chemical experiments;	6,12	zzes, Exam
3. identify the basic glassware and equipment in the laboratory;	6,12	zes, Exam

4. state the differences between primary and secondary standards;	6,12	zes, Exam
5. perform redox titration;	6,12	zes, Exam
6. record observations and measurements in the laboratory notebooks; and	6,12	zes, Exam
7. analyze the data to arrive at scientific conclusions.	6,12	zes, Exam

MTH 111: Elementary Mathematics I (Algebra and Trigonometry)

Catalog Description: Elementary Mathematics I cover algebra and trigonometry basics. Students learn equations, functions, graphing, and basic trigonometric concepts. Emphasizes problem-solving, mathematical reasoning, and critical thinking. Provides a strong foundation for further mathematical studies.

rse Learning Outcomes (CLO): Upon successful completion of ourse, students will be able to:		**ssment Tools**
1. define and explain set, subset, union, intersection, complements, and demonstrate the use of Venn diagrams;	3	ework, Quizzes, n
2. solve quadratic equations;	3	ework, Quizzes, n
3. solve trigonometric functions;	3	ework, Quizzes, n
4. identify various types of numbers; and	3	ework, Quizzes, n
5. solve some problems using binomial theorem.	3	ework, Quizzes, n
6. define and explain set, subset, union, intersection, complements, and demonstrate the use of Venn diagrams;	3	ework, Quizzes, n
7. solve quadratic equations;	3	ework, Quizzes, n

PHY 111: General Physics I

Catalog Description: General Physics I introduce fundamental physics principles. Topics include motion, forces, energy, and momentum. Covers mechanics, including Newton's laws and rotational motion. Students gain conceptual understanding through lectures and problem-solving. Prepares for further studies in physics.

rse Learning Outcomes (CLO): Upon successful completion of ourse, students will be able to:		**ssment Tools**
1. identify and deduce the physical quantities and their units;	6	ework, Exam
2. differentiate between vectors and scalars;	6	ework, Quizzes, n
3. describe and evaluate motion of systems on the basis of the fundamental laws of mechanics;	6	ework, Quizzes, n
4. apply Newton’s laws to describe and solve simple problems of motion;	6	ework, Quizzes, n
5. evaluate work, energy, velocity, momentum, acceleration, and torque of moving or rotating objects;	6	ework, Quizzes, n
6. explain and apply the principles of conservation of energy, linear and angular momentum;	6	ework, Quizzes, n

7. describe the laws governing motion under gravity; and	6	ework, Quizzes, n
8. explain motion under gravity and quantitatively determine behavior of objects moving under gravity.	6	ework, Quizzes, n

CEE 121: Computer Programming

Catalog Description: The Computer Programming course teaches undergraduate students fundamental programming skills. Students learn programming concepts, algorithms, and data structures using languages like Python, Java, or C++. Focuses on problem-solving, logical thinking, and program efficiency. Students gain hands-on experience and develop the ability to create simple software applications.

rse Learning Outcomes (CLO): Upon successful completion of ourse, students will be able to:		**ssment Tools**
1. Provide vivid descriptions on the concept of programming logic, programs, algorithms and flowcharts.	11	ework, Exam
2. Design, implement, debug and test small programs using different programming paradigms	11	ework, Quizzes, n
3. Use common programming tools such as compilers, editors and debuggers to design, implement, debug and test small programs.	11	ework, Quizzes, n
4. Demonstrate a clear understanding of the relative advantages and disadvantages of each programming tool skills	11	ework, Quizzes, n

PHY 197: General Practical Physics I

Catalog Description: General Practical Physics I is a hands-on lab course for undergraduates. Students perform physics experiments to reinforce concepts in mechanics, heat, and optics. Develops practical lab skills, critical thinking, and safety awareness. Enhances understanding and application of physics principles in a laboratory context.

rse Learning Outcomes (CLO): Upon successful completion of ourse, students will be able to:		**ssment Tools**
1. conduct measurements of some physical quantities	6,12	zes, Exam
2. make observations of events, collect and tabulate data	6,12	zes, Exam
3. identify and evaluate some common experimental errors	6,12	zes, Exam
4. plot and analyze graphs	6,12	zes, Exam
5. draw conclusions from numerical and graphical analysis of data	6,12	zes, Exam
6. prepare and present practical reports.	6,12	zes, Exam
7. conduct measurements of some physical quantities	6,12	zes, Exam

GST 112: Communication in English II

Catalog Description: Communication in English II enhances undergraduate students' advanced written and oral communication skills. Focuses on complex idea expression, critical thinking, and effective presentations. Covers advanced grammar, vocabulary, and persuasive writing. Emphasizes intercultural communication for diverse settings. Prepares students for academic and professional contexts.

rse Learning Outcomes (CLO): Upon successful completion of ourse, students will be able to:		**ssment Tools**

1. advance paragraphs in a logical and coherent manner;		ework, Quizzes, n
2. change outlines and create supporting		ework, Quizzes, n
3. identify and write topic sentences and attain coherence in written English;		ework, Quizzes, n
4. mark various forms of essays (narrative, descriptive, expository and argumentative/persuasive);		ework, Quizzes, n
5. distinguish and produce as accurately as possible, the English vowels and consonants;		
6. distribute an effective public speech		ework, Quizzes, n

GST 118: Peace and Conflict Resolution

Catalog Description: The Peace and Conflict Resolution course delves into theories, practices, and strategies for promoting peace and resolving conflicts. Covers root causes of conflicts and approaches to conflict resolution. Examines the role of international organizations and civil society in peacebuilding. Develops critical thinking and problem-solving skills. Explores various case studies. Provides a comprehensive understanding of peacebuilding processes and strategies.

rse Learning Outcomes (CLO): Upon successful completion of ourse, students will be able to:		**ssment Tools**
1. define and explain the meaning and nature of conflict		ework, Exam
2. discuss the causes and types of conflicts		ework, Quizzes, n
3. discuss issues on conflict analysis, management, resolution and transformation		ework, Quizzes, n
4. explain the processes of conflict resolution – mediation negotiation, arbitration, litigation, conciliation and so on		ework, Quizzes, n
5. give detailed explanation of peace education		
6. examine the role of communication and language in conflicts		ework, Quizzes, n

GST 114: Social Sciences

Catalog Description: The Social Sciences course explores human society and behavior through multiple disciplines. Covers sociology, psychology, anthropology, economics, and political science. Examines social interactions, cultural diversity, structures, systems, and processes. Promotes understanding of human behavior and societal issues. Highlights interconnectedness within broader social contexts.

rse Learning Outcomes (CLO): Upon successful completion of ourse, students will be able to:		**ssment Tools**
1. Understand the concepts of geography as a scientific discipline	3	ework, Exam
2. Examine the sense of location specification, including an appreciation of forms and structure of Nigeria n settlement pattern, economic activities and challenges	4	ework, Quizzes, n
3. Provide understanding on the relationships in economic and political geography of both in history and in the contemporary with the aim of creating environmental consciousness	, 12	ework, Quizzes, n

MEC-122 Basic Engineering Drawing

Catalog Description: Basic Engineering Drawing teaches students principles and techniques of technical drawing. Covers geometric construction, projection, dimensioning, sectioning, and tolerancing. Develops skills in creating and interpreting engineering drawings. Emphasizes accuracy, precision, and clear documentation in engineering design.

rse Learning Outcomes (CLO): Upon successful completion of ourse, students will be able to:		**ssment Tools**
1. Elucidate drawing as a means of communication.	3,6	ework, Quizzes, n
2. Construct borderlines and dimensioning.	3,6	ework, Quizzes, n
3. Illustrate drawing, measuring, lettering and dimensioning of objects in various views/positions;	3,6	ework, Quizzes, n
4. Identify the various types of lines, their applications and geometry;	3,6	ework, Quizzes, n
5. Demonstrate the geometrical construction of parallel and perpendicular lines, bisection and division of lines,	3,6	ework, Quizzes, n
6. Draw construction and bisection of angles.	3,6	ework, Quizzes, n
7. Construct triangles, inscribed, ascribed and circumscribed circles of triangle, quadrilaterals, polygons, circle and geometrical construction on circle	3,6	ework, Quizzes, n
8. Demonstrate freehand sketching, symbols, conventions a scale	3,6	ework, Quizzes, n

ICH 112: General Chemistry II

Catalog Description: General Chemistry II expands on foundational concepts from General Chemistry I. Covers advanced topics like kinetics, equilibrium, thermodynamics, and organic chemistry. Emphasizes problem-solving and laboratory skills. Applies chemical principles to real-world contexts. Preparatory for advanced chemistry studies.

rse Learning Outcomes (CLO): Upon successful completion of ourse, students will be able to:		**ssment Tools**
1. state the importance and development of organic chemistry;		ework, Quizzes, n
2. define fullerenes and its applications;		ework, Quizzes, n
3. discuss electronic theory;		ework, Quizzes, n
4. determine the qualitative and quantitative of structures in organic chemistry;		ework, Quizzes, n
5. state rules guiding nomenclature and functional group classes of organic chemistry;		ework, Quizzes, n
6. determine the rate of reaction to predict mechanisms of reaction;		ework, Quizzes, n
7. identify classes of organic functional group with brief description of their chemistry;		ework, Quizzes, n

8. discuss comparative chemistry of group 1A, IIA and IVA elements; and		ework, Quizzes, n
9. describe basic properties of transition metals.		ework, Quizzes, n

ICH 198: General Practical Chemistry II

rse Learning Outcomes (CLO): Upon successful completion of ourse, students will be able to:		**ssment Tools**
1. state the general laboratory rules and safety procedures;		zes, Exam
2. collect scientific data and correctly carry out chemical experiments;		zes, Exam
3. identify the basic glassware and equipment in the laboratory;		zes, Exam
4. identify and carry out preliminary tests which include ignition, boiling point, melting point, test on known and unknown organic compounds;		zes, Exam
5. carry out solubility tests on known and unknown organic compounds;		zes, Exam
6. carry out elemental tests on known and unknown compounds; and		zes, Exam
7. carry out functional group/confirmatory test on known and unknown compounds which could be acidic/basic/ neutral organic compounds.		zes, Exam

MAT 112: Elementary Mathematics II (Calculus)

Catalog Description: Elementary Mathematics II (Calculus) introduces undergraduates to fundamental calculus concepts. Covers limits, derivatives, and integrals. Explores applications in various fields. Emphasizes problem-solving and mathematical modeling. Provides a foundation for advanced math studies.

rse Learning Outcomes (CLO): Upon successful completion of ourse, students will be able to:		**ssment Tools**
1. identify the types of rules in differentiation and integration;		ework, Quizzes, n
2. recognize and understand the meaning of function of a real variable, graphs, limits and continuity;		ework, Quizzes, n
3. solve some applications of definite integrals in areas and volumes;		ework, Quizzes, n
4. solve function of a real variable, plot relevant graphs, identify limits and idea of continuity;		ework, Quizzes, n
5. identify the derivative as limit of rate of change;		ework, Quizzes, n
6. identify techniques of differentiation and perform extreme curve sketching;		ework, Quizzes, n
7. identify integration as an inverse of differentiation;		ework, Quizzes, n
8. identify methods of integration and definite integrals; and		ework, Quizzes, n
9. perform integration application to areas, volumes.		ework, Quizzes, n

PHY 112 General Physics II

Catalog Description: General Physics II expands on concepts from General Physics I. Topics include electricity, magnetism, optics, waves, and modern physics. Emphasizes understanding and applications of advanced physics topics. Develops critical thinking and problem-solving skills. Incorporates demonstrations and problem-solving exercises.

rse Learning Outcomes (CLO): Upon successful completion of ourse, students will be able to:		**ssment Tools**
1. Explain the general properties of waves.	6	ework, Quizzes, n
2. Describe the general properties of sound.	6	ework, Quizzes, n
3. Describe what static electricity is and how it originates.	6	ework, Quizzes, n
4. Demonstrate an understanding of electrical potential.	6	ework, Quizzes, n
5. Analyze electrical circuits. .	6	ework, Quizzes, n
6. Define the properties of magnetic fields.	6	ework, Quizzes, n
7. Clarify how light interacts with lenses and mirrors. .	6	ework, Quizzes, n
8. Label optical phenomena associated with the wave properties of light.	6	ework, Quizzes, n
9. Designate quantum theory and how it relates to the model of the atom	6	ework, Quizzes, n

PHY 198 General Practical Physics II

rse Learning Outcomes (CLO): Upon successful completion of ourse, students will be able to:		**ssment Tools**
1. Be able to prepare a written laboratory report that effectively interprets and communicates their results.	6,12	zes, Exam
2. Be able to effectively use computers as a tool for communication, data collection, data analysis.	6,12	zes, Exam
3. Perform at least 10 laboratory activities where students collect, organize and analyze data demonstrating concepts from the 8 major objectives listed above	6,12	zes, Exam

MME 122 Engineering Materials

Catalog Description: Engineering Materials is an undergraduate course that covers properties, selection, and behavior of materials. Topics include metals, ceramics, polymers, and composites. Explores material properties, mechanical behavior, and processing. Includes laboratory experiments and practical applications. Develops material testing and analysis skills. Prepares students to make informed material selection decisions in engineering**.**

rse Learning Outcomes (CLO): Upon successful completion of ourse, students will be able to:		**ssment Tools**
1. Show a systematic understanding of the role that crystal structures play in material properties.		ework, Quizzes, n

2. Evaluate critically the relevance of phase diagrams, isothermal transformation diagrams and continuous cooling transformation diagrams to understanding real alloys and their microstructure		ıework, Quizzes, n
3. Display a critical awareness of the relevance of key areas, e.g., diffusion, defects, transformation type, to current problems in designing, processing and exploiting real alloys.		ıework, Quizzes, n
4. Show a systematic understanding of the complex interplay between microstructure, processing and engineering properties in metallic materials.		ıework, Quizzes, n

200 Level Courses

FEG 221: Engineer-in-Society

Catalog Description: This course focuses on the history of Engineering and Technology. It provides an understanding of the functions and roles of engineering Professional bodies in Nigeria, the importance of sustainable development, engineering problem solving, communication, and leadership skills to the students. The course also leverages the knowledge of professional ethics to the students.

rse Learning Outcomes (CLO): Upon successful completion of the se, students will be able to:		**ssment Tools**
1. Develop heuristic knowledge on the historical development of engineering and technology	,4	ıework, Quizzes, n
2. Recognize the regulatory body, COREN and the process and requirements for professional registration	,4	ıework, Quizzes, n
3. Identify the pyramidal structure of the cadres in the engineering profession	3,4	ıework, Quizzes, n
4. Recognize the importance of sustainable development.		ıework, Quizzes, n
5. State the code of conduct and fundamental Ethics of Engineering profession		ıework, project
6. Implement engineering problem solving	,11	ıework, Quizzes, n
7. Identify issues and challenges as an engineer after graduation.		ıework, Quizzes

FEG 294: Laboratory Practical II

Catalog Description: FEG 294 introduces the students to the basic electrical and electronic equipment in the lab. This helps the students to be able to deal with some of the frequently used instruments and equipment; like the digital multimeter and DC Power supply, operation of hand and powered tools for wood and metal cutting and fabrication.

rse Learning Outcomes (CLO): Upon successful completion of the se, students will be able to:		**ssment Tools**
velop effective communication skill by delivering a seminar based on project	,4	ıework, zes, Exam
1. Demonstrate a through and systematic understanding of project contents.	,4	ıework, zes, Exam
2. Develop heuristic knowledge on key stages in development of a project.	3,4	ıework, zes, Exam
3. Conduct effective trouble-shooting of a mini project		ıework, project

4. Carry out budget and time planning for a project	2,13	ework, Project, n

EEE 221: Applied Electricity I

Catalog Description: After successful completion of EEE 221, students will be able to understand the basic electrical engineering principles and abstractions on which the design of electronic systems is based. These include lumped circuit models, digital circuits, and operational amplifiers. Build circuits and take measurements of circuit variables using tools such as oscilloscopes, multimeters, and signal generators. Compare the measurements with the behavior predicted by mathematic models and explain the discrepancies. Understand the relationship between the mathematical representation of circuit behavior and corresponding real-life effects.

FEG 227: Engineering Analysis and Computation I

rse Learning Outcomes (CLO): Upon successful completion of the se, students will be able to:		**ssment Tools**
1. Employ simple lumped circuit models for resistors, sources, inductors, capacitors, and transistors in circuits.	3	ework, Quizzes, n
2. Analyze circuits made up of linear lumped elements. Specifically, circuits containing resistors and independent sources using techniques such as the node method, superposition and the Thevenin method	3,6	ework, Quizzes, n
3. Calculate the frequency response of circuits containing resistors, capacitors and inductors.	3	ework, Quizzes, n
4. Calculate the time behavior of first order and second order circuits containing resistors, capacitors and inductors	7	ework, project
5. Carry out a small-signal analysis of an amplifier using small signal models for the circuit elements.	12,	ework, Project, n

Catalog Description: Engineering Mathematics and Computation I is an introductory course that teaches students the basics of mathematics and computational methods in engineering. Topics include calculus, linear algebra, differential equations, and numerical analysis. Students will learn to apply mathematical concepts and computational tools to solve engineering problems. The course focuses on developing mathematical modeling skills and problem-solving abilities for engineering applications.

rse Learning Outcomes (CLO): Upon successful completion of course, students will be able to:		**ssment Tools**
rry out addition and subtraction of complex numbers, iplication of complex numbers, conjugate complex number and sion of complex numbers.	3	ework, Quizzes, n
rry out of addition of two vectors, multiplication of vector by ars, orthogonal triad of unit vectors, vector products, laws of cross ucts.	3	ework, Quizzes, n
scribe trigonometric rations and trigonometric identity.	3	ework, Quizzes, n
plain exponential functions and logarithmic function	3	ework, Quizzes, n
ide to solving partial fractions, solve denominator with repeated quadratic factors.	3	ework, project

rry out addition and subtraction of polynomials, types of nomials, multiplication and division of polynomials, factor rem.	3	ework, Quizzes, n
sic concepts, Carry out addition and subtraction of matrices, iplication of matrices, determinant of matrix, eigenvalues and nvectors, linear equations.	3	ework, Quizzes

FEG 228: Engineering Analysis and Computation II

Catalog Description: Engineering Mathematics and Computation II is an advanced course that covers advanced calculus, linear algebra, differential equations, and numerical methods. It focuses on applying mathematical techniques to engineering problems and using computational tools for complex problem-solving. The course prepares students for advanced engineering courses and real-world applications.

rse Learning Outcomes (CLO): Upon successful completion of ourse, students will be able to:		**ssment Tools**
pply advanced calculus techniques to solve engineering problems.	3	ework, Quizzes, n
monstrate proficiency in linear algebra concepts and their ications in engineering.	3	ework, Quizzes, n
lve higher-order linear differential equations and systems of rential equations using appropriate methods.	3	ework, Quizzes, n
ilize numerical methods to solve complex mathematical problems simulate engineering systems.	3	ework, Quizzes, n
pply optimization techniques to maximize or minimize engineering ctives under given constraints.	3	ework, project
alyze and interpret data using advanced probability and statistical niques.	3	ework, Quizzes, n
pply complex analysis tools to analyze and solve engineering lems.	3	ework, Quizzes

Course: Engineering Drawing, I

Catalog Description: Engineering Drawing I is an introductory course that teaches students the basics of creating and understanding engineering drawings. It covers manual drafting techniques and CAD software, focusing on topics like geometric construction, projection, dimensioning, sectioning, and tolerancing. Students learn to communicate engineering designs accurately and effectively through drawings.

rse Learning Outcomes (CLO): Upon successful completion of ourse, students will be able to:		**ssment Tools**
1. Apply multi-view representation techniques accurately to represent objects in different views, demonstrating proficiency in both first and third angle projection methods.	.2	ework, Quizzes, n
2. Create isometric drawings and simple pictorial assembly drawings, accurately representing the spatial relationship between components and assemblies.	.2	ework, Quizzes, n
3. Generate oblique drawings using different techniques such as cavalier, cabinet, and angles other than 45 degrees, effectively communicating the shape and features of objects.	.2	ework, Quizzes, n

4. Apply proper dimensioning techniques, including the selection and placement of dimension lines, the use of tolerances, and the application of GD&T symbols, ensuring clear and accurate communication of size and shape requirements.	.2	ıework, Quizzes, n
5. Interpret and create sections and auxiliary views, correctly representing the internal features and hidden details of objects, and apply the appropriate conventions for representing threads, bolted joints, keys, cottoned joints, and other mechanical components based on relevant standards such as BS 308	.2	

Course: CHE 225: Fundamental of Fluid Mechanics

Catalog Description: The Fundamentals of Fluid Mechanics course teaches students about the behavior and properties of fluids and how they interact with their surroundings. It covers topics like fluid properties, flow measurements, and conservation laws. Students learn to analyze fluid flow problems in pipes and channels, and explore practical applications of fluid mechanics.

rse Learning Outcomes (CLO): Upon successful completion of ourse, students will be able to:		**ssment Tools**
1. Demonstrate a solid understanding of fluid properties, including viscosity, density, and pressure, and apply this knowledge to analyze fluid statics and pressure distributions in various scenarios.		ıework, Quizzes, n
2. Apply the conservation laws of mass, energy, and momentum to analyze and solve problems related to fluid flow in pipes, ducts, and other hydraulic systems.		ıework, Quizzes, n
3. Analyze and quantify friction losses in laminar and turbulent flows, and utilize appropriate equations and models to calculate pressure drop and flow rates in fluid systems.		ıework, Quizzes, n
4. Utilize dimensional analysis techniques to establish dimensionless groups and scaling laws, and apply them to solve problems related to model testing and fluid system design.		ıework, Quizzes, n
5. Understand the construction and operation principles of hydraulic machinery, including pumps and turbines, and evaluate their performance characteristics and efficiency in different applications		

Course: CVE 227: Applied Mechanics

Catalog Description: The "Applied Mechanics" course focuses on the practical application of mechanics principles to solve real-world engineering problems. It covers a range of topics related to the behavior of structures and machines. Throughout the course, students will learn how to apply mechanics principles to analyze and solve practical engineering problems. They will develop skills in structural analysis, machinery behavior, and the prevention of mechanical failures, gaining a solid foundation in applied mechanics.

rse Learning Outcomes (CLO): Upon successful completion of ourse, students will be able to:		**ssment Tools**

lyze the concepts of friction, wear and lubrication applications in matics;	.2	ıework, Quizzes, n
Explain the principles of selection of power screws, belt, ropes chains drives,	.2	ıework, Quizzes, n
Explain the principles of selection clutches, brakes	.2	ıework, Quizzes, n
Explain the principles of selection dynamometer and its ication in torque	.2	ıework, Quizzes, n
Differentiate between Hydrodynamics and hydrostatic cation;	.2	ıework, Quizzes, n
Explain tribology and its associated problems	.2	ıework, Quizzes, n

Course: CEE 221: Introduction to Modeling and Simulation

Catalog Description: Introduction to Modeling and Simulation is a course that teaches students how to create and use models to simulate real-world systems. It covers model development, simulation algorithms, validation, and analysis of results. Students gain hands-on experience through exercises and projects.

rse Learning Outcomes (CLO): Upon successful completion of ourse, students will be able to:		**ssment Tools**
ave a good grasp of design thinking and be obsessed with the rmination to apply such to solving simple every day and also plex problems using MATLAB	),12	ıework, Quizzes, n
Recognize the fundamental concepts of functions and basic ing, vector and matrix generation, array operations, and linear and inear equations. Programming (M-file scripts and functions)	),12	ıework, Quizzes, n
how good skills in programming languages in the world of neering objects in actionable solid models, and put such models in m where they can be inputs for simulation and analyses;	),12	ıework, Quizzes, n
Have knowledge of facility development in simulation model ling, examples/area of applications prepare the objects for modern uction and manufacturing techniques of additive and subtractive ufacturing;	),12	ıework, Quizzes, n
Describe some open circuit simulator software like Proteus, tisim, PECS	),12	ıework, Quizzes, n
ave a good grasp of design thinking and be obsessed with the rmination to apply such to solving simple every day and also plex problems using MATLAB	),12	ıework, Quizzes, n

Course: Applied Electricity II

Catalog Description: Applied Electricity II is an advanced-level course that builds upon the concepts and principles covered in Applied Electricity I. This course focuses on the practical application of electrical engineering principles in various real-world scenarios. Students will delve deeper into topics such as circuit analysis, power systems, electric machines, and electronic devices.

rse Learning Outcomes (CLO): Upon successful completion of ourse, students will be able to:		**ssment Tools**
pply advanced circuit analysis techniques to analyze and solve plex electrical circuits.	3	ıework, Quizzes, n

derstand and analyze power systems, including transmission, ibution, and power factor correction.	3	ework, Quizzes, n
aluate and analyze the characteristics and performance of electric hines, such as DC and AC motors.	3	ework, Quizzes, n
derstand the principles of electronic devices, including conductors, diodes, transistors, amplifiers, and logic gates.	3	ework, Quizzes, n
monstrate practical skills in conducting experiments, surements, and analysis related to electrical circuits and systems.	3	ework, Quizzes, n
ply theoretical knowledge to real-world scenarios and make rmed decisions in the design and operation of electrical systems.	3	ework, Quizzes, n
ork effectively in teams to solve electrical engineering problems communicate findings effectively.	3	ework, Quizzes, n

Course: MEC 224: Engineering Drawing II

Catalog Description: MEC 224 is an advanced course that builds upon the basics of Engineering Drawing I. It covers topics such as assembly drawings, machine components, tolerancing, and CAD. The course aims to develop skills in creating precise and detailed engineering drawings for different engineering fields.

rse Learning Outcomes (CLO): Upon successful completion of ourse, students will be able to:		**ssment Tools**
1. Apply projection techniques to accurately project points, lines, planes, and solids onto different views, demonstrating proficiency in graphical representation.	.2	ework, Quizzes, n
2. Analyze and determine intersections of solids, effectively representing complex geometric relationships and providing comprehensive engineering drawings.	.2	ework, Quizzes, n
3. Interpret and represent cam profiles, showcasing an understanding of cam mechanisms and their applications in mechanical systems.	.2	ework, Quizzes, n
4. Develop surfaces accurately, utilizing appropriate methods such as ruling and triangulation to represent curved and irregular shapes in engineering drawings.	.2	ework, Quizzes, n
5. Create detailed drawings of mechanical components, including belts, chains, gears, bearings, lubrication arrangements, couplings, brakes, flexible shafts, universal joints, etc., incorporating appropriate dimensions, tolerances, and annotations to convey design specifications.	.2	ework, Quizzes, n

Course: CHE 226: Fundamental of Thermodynamics

rse Learning Outcomes (CLO): Upon successful completion of ourse, students will be able to:		**ssment Tools**
1. principles of thermodynamics, including the Zeroth, First, Second, and Third Laws of Thermodynamics.	6	ework, Quizzes, n
2. Apply mathematical relationships and equations to solve thermodynamics problems, including calculations involving heat, work, energy, and entropy.	6	ework, Quizzes, n
3. Analyze and predict the properties and changes in state of pure substances using thermodynamic principles,	6	ework, Quizzes, n

including phase diagrams, heat capacities, and enthalpy calculations.		
4. Apply thermodynamic principles to analyze and predict the behavior of perfect gases, including the ideal gas law, specific heat capacities, and gas power cycles.	6	ıework, Quizzes, n
5. Analyze and evaluate the performance of ideal gas cycles, including efficiency calculations, optimization techniques, and the impact of different cycle parameters	6	ıework, Quizzes, n

Course: CVE 228: Strength of Materials

Catalog Description: The Strength of Materials course teaches students about the behavior and properties of engineering materials under different loads and stresses. It covers topics like stress analysis, material properties, and failure analysis. Students learn to apply mathematical and engineering principles to solve problems in structural and mechanical design.

rse Learning Outcomes (CLO): Upon successful completion of ourse, students will be able to:		**ssment Tools**
recognize a structural system that is stable and in equilibrium;	,6	ıework, Quizzes, n
determine the stress-strain relation for single and composite bers based on Hooke's law;	,6	ıework, Quizzes, n
estimate the stresses and strains in single and composite members o temperature changes;	,6	ıework, Quizzes, n
evaluate the distribution of shear forces and bending moments eams with distributed and concentrated loads;	,6	ıework, Quizzes, n
determine bending stresses and their use in identifying slopes and ections in beams;	,5,6	ıework, Quizzes, n
se Mohr's circle to evaluate the normal and shear stresses in a i-dimensional stress system and transformation of these stresses strains;		ıework, Quizzes, n

Course: FEG 290: Students Industrial Work Experience (SIWES I)

Catalog Description: This course is designed to make students conversant with industrial workplace perceptions, ethics, health and safety consciousness, interpersonal skills, and technical capabilities needed to give them a sound engineering foundation. Learning and practicing basic engineering techniques and processes applicable to their specializations. Building machines, devices, structures, or facilities relevant to their specific engineering programs and applications; and acquiring competence in technical documentation (log-book) and presentation (report) of their practical experiences.

rse Learning Outcomes (CLO): Upon successful completion of ourse, students will be able to:		**ssment Tools**
1. acquire industrial workplace perceptions, ethics, health and safety consciousness, inter-personal skills and technical capabilities needed to give them a sound engineering foundation;	0,12	ıework, Quizzes, n
2. learn and practice basic engineering techniques and processes applicable to their specializations;	0,12	ıework, Quizzes, n
3. build machines, devices, structures or facilities relevant to their specific engineering programmes and applications; and	0,12	ıework, Quizzes, n

4. acquire competence in technical documentation (log-book) and presentation (report) of their practical experiences.	0,12	ework, Quizzes, n

300 Level Courses

ENS 311: Entrepreneurship

rse Learning Outcomes (CLO): Upon successful completion of course, students will be able to:		**ssment Tools**
1. Understand and evaluate engineering business opportunities.	3	ework, Exam
2. Employ innovative problem-solving strategies in engineering entrepreneurship.	4	ework, zes, Exam
3. Create and manage engineering-based ventures, including business planning, funding acquisition, and legal compliance.	, 12	ework, zes, Exam
4. Demonstrate effective leadership and communication skills in multidisciplinary engineering environments.	9	ework, zes, Exam
5. Apply ethical and sustainable practices in engineering entrepreneurship.	2	
6. Adapt and navigate emerging opportunities and challenges in the engineering entrepreneurship landscape.	0	ework, zes, Exam

FEG 321: Engineering Analysis and Computation III

rse Learning Outcomes (CLO): Upon successful pletion of the course, students will be able to:		**ssment Tools**
1. Apply mathematical and computational techniques to solve engineering problems.	5	ework, Exam
2. Demonstrate proficiency in programming languages and computational software.	3, 10	ework, Quizzes, n
3. Analyze and interpret engineering data using statistical methods and computational tools.	, 12	ework, Quizzes, n
4. Formulate mathematical models for engineering systems to analyze system behavior and predict outcomes.	9	ework, Quizzes, n
5. Apply numerical methods to solve complex engineering equations.	9	
6. Communicate engineering analysis and computational results effectively to technical and non-technical audiences.	6	ework, Quizzes, n

EEE 313: Circuit Theory I

Catalog Description: Circuit Theory 1 is an introductory course that provides students with a solid foundation in circuit analysis and network theorems. The course covers a wide range of topics, including Kirchhoff's Laws, steady-state and transient state analysis, and network response to various input signals such as steps, ramps, impulses, exponentials, and sinusoids. Students will also learn about the Laplace transform and its application in analyzing RL, RC, and RLC circuits with one and two loops. The course introduces the concepts of initial and final value theorems. Further topics include a review of Fourier transformation in circuit analysis, pole-

zero analysis, network synthesis, resonance, two-point analysis, ladder networks, Star-Delta transformation, superposition theorem, reciprocity, Thevenin's and Norton's theorems, and the maximum power transfer theorem. Students will gain a deep understanding of these concepts and their practical applications in electrical circuits.

rse Learning Outcomes (CLO): Upon successful completion of the se, students will be able to:		**ssment ls**
1. Analytical Skills: Students will learn to analyze circuits using Kirchhoff's Laws and solve problems in steady-state and transient states. They will study network responses to different input signals.		ıe Work, , Exam
2. Mathematical Modeling: Students will use Laplace transforms to mathematically model circuits and understand their behavior in both time and frequency domains.		ıe Work, n
3. Circuit Synthesis and Analysis: Students will learn advanced analysis techniques like pole-zero analysis, network synthesis, and resonance. They will also study ladder networks and the Star-Delta transformation method to simplify complex circuits.	12	ıe Work, , Exam
4. Theorems and Principles: Students will understand important theorems such as Superposition, Reciprocity, Thevenin's, Norton's, and Maximum Power Transfer theorems, which will aid in simplifying circuit analysis and optimizing performance.	6	ıe Work, n
5. Practical Application: Students will apply Circuit Theory knowledge to real-world scenarios, designing and analyzing practical circuits. This enhances problem-solving skills and prepares students for electrical engineering careers.	6, 12	nework, ect, exam

EEE 323: Digital Electronic Circuits

Catalog Description: Digital Electronic Circuits is an introductory course that teaches the principles and applications of digital logic circuits. It covers number systems, logic gates, logic expressions, and their realization using switches. The course emphasizes obtaining logic circuits from expressions and vice versa, using methods like Boolean algebra and simplification tools such as Karnaugh maps. It also covers implementing logic gates with transistors, various codes, counters, registers, and applications like encoders, multiplexers, adders, RAM, ROM, and PLAs. The course concludes with an introduction to microprocessors, covering architecture, memory organization, and applications.

rse Learning Outcomes (CLO): Upon successful completion of ourse, students will be able to:		**ssment ls**
ımber Systems: Students learn binary, octal, decimal, and decimal systems, and how to convert between them for working electronic circuits.		ıework, Quiz, n
gic Gates and Circuits: Students study logic gates like AND, OR, , NAND, NOR, and XOR, and learn to analyze and create logic its using these gates.		ıework, ect, Exam
olean Algebra and Simplification: Students become skilled in lean algebra and use techniques like Karnaugh maps to simplify expressions, optimizing circuit complexity.		ıework, Quiz, n
des and Data Representation: Students explore codes like BCD, II, EBCDIC, and gray code, and understand how they represent data gital circuits.	2	ıework, n

roduction to Microprocessors: Students get introduced to oprocessors and their architecture, including memory organization nteraction with peripherals like RAM, ROM, and PLA. This serves foundation for further exploration of microprocessor-based systems.	6	ect, Exam

EEE 325: Physical Electronics

Catalog Description: Physical Electronics is a comprehensive course that explores the fundamental principles and theories underlying electronic devices and semiconductor technology. The course covers a wide range of topics, starting with an examination of free electron motion in static electric, magnetic, and electromagnetic fields. Students will gain a deep understanding of atomic theory, including Bohr's model and quantum theory, which form the basis for understanding electron behavior in materials. The course delves into the engineering-band theory of conductors, insulators, and semiconductors, providing insights into their unique electrical properties. The study of semiconductor theory encompasses intrinsic and extrinsic semiconductors, n-type and p-type semiconductors, and their formation. Students will explore the concept of the Fermi energy level and its significance in electronic materials.

The course then focuses on PN-junctions, examining their operation, characteristics, and applications. This includes an in-depth study of PN-junction diodes, such as rectifier diodes, varactor diodes, Schottky diodes, and Zener diodes. Students will gain a solid understanding of their operation principles and practical applications. Furthermore, the course covers bipolar junction transistors (BJTs) and field-effect transistors (FETs). Students will learn about different types of BJTs and FETs, their operation principles, characteristics, modes of connection, and applications. The course also introduces thyristors and explores their operation, characteristics, and applications. Additionally, the course provides an introduction to semiconductor technology, giving students an overview of the manufacturing processes and techniques used in the production of electronic devices.

rse Learning Outcomes (CLO): Upon successful completion of the se, students will be able to:		**essment ls**
nderstanding Electron Motion: Students learn how electric, magnetic, and romagnetic fields affect the behavior of electrons, providing a basis for ying electronic devices and circuits.		nework, m
omic Theory and Semiconductor Properties: Students explore atomic ry and quantum theory to understand electron behavior in materials, uding conductors, insulators, and semiconductors.	5	nework, Quiz, m
I-Junction and Diodes: Students study PN-junctions and diodes, their lation, characteristics, and applications in rectifiers, varactors, Schottky es, and Zener diodes.	5, 12	, Project, m
polar Junction Transistors: Students gain knowledge about bipolar tion transistors (BJTs), their types, operation, characteristics, and circuit gn, as well as their applications in electronic devices and amplifiers.	5,6	nework, ect, Exam
eld-Effect Transistors and Thyristors: Students learn about field-effect istors (FETs), their types, operation, characteristics, and circuit nections, along with an introduction to thyristors and their applications in er control circuits.	5,6	nework, Quiz, m
roduction to Semiconductor Technology: Students are introduced to conductor manufacturing processes, including materials, doping niques, and cleanroom environments, to understand the basics of conductor technology and its applications.	5,6	nework, Quiz, m

EEE 341: Electromagnetic Fields and Waves I

Catalog Description: Electromagnetic Fields and Waves I is an introductory course that covers the study of electromagnetic fields and their behavior. The course includes topics such as vector analysis techniques, electromagnetic laws, magnetic fields, electromagnetic induction, Maxwell's equations, and the Poynting vector. Students will gain a comprehensive understanding of electromagnetic phenomena and their practical applications.

rse Learning Outcomes (CLO): Upon successful completion of the se, students will be able to:		**ssment Tools**
udents will enhance their skills in manipulating and analyzing vectors in context of electromagnetic fields.	3	, Exam
udents will learn and apply electromagnetic laws, such as Gauss's law and ere's law, to analyze electric and magnetic fields.	3	ework, Exam
udents will study magnetic fields in and around current-carrying uctors, using principles like the Biot-Savart law and Ampere's law.	3	ework, Exam
udents will explore the behavior of electromagnetic fields with time- ing phenomena and understand Maxwell's equations.	3	ework, Exam
udents will learn about the Poynting vector, which represents the direction magnitude of electromagnetic power flow, and gain insights into energy mission and distribution.	3	ework, Exam

EEE 343: Electromechanical Devices and Machines I

Catalog Description: Electromechanical Devices and Machines I is an introductory course covering the basics of electromechanical systems. Students learn about electrical and mechanical components, gain practical skills, and prepare for careers in power generation, manufacturing, robotics, and automation.

Pre-requisite(s):

rse Learning Outcomes (CLO): Upon successful completion of the se, students will be able to:		**ssment ls**
1. Understand the principles of electromechanical devices.	3	ework, Quiz, n
2. Analyze the behavior and performance of electromechanical systems.	3,5,12	ework, Quiz, n
3. Apply mathematical modeling and analysis techniques.	3,5,12	ework, Quiz, n
4. Design and optimize electromechanical systems.	3,5,12	ework, n
5. Develop skills in troubleshooting and diagnosing electromechanical faults.	3,12	ect, Exam

EEE 391: Laboratory practical I

Catalog Description: The Electrical and Electronic Engineering Laboratory Practical I course offers hands-on experience in electrical and electronic engineering. Students learn circuit analysis, measurements, electronic components, and digital systems. They gain practical skills in designing, constructing, and troubleshooting circuits using industry-standard tools. The course emphasizes safety, problem-solving, and effective communication. It serves as a foundation for further laboratory-based courses.

rse Learning Outcomes (CLO): Upon successful completion of the se, students will be able to:		**ssment Tools**
1. Magnetic Circuits: Students learn electromagnetism laws, B-H curves, and the significance of magnetic materials. They study electromagnets, permanent magnets, relays, and actuators.	, 6, 12	ework, tical, Quiz, n

2. Transformers: Students understand ideal transformers, equivalent circuits, analysis techniques, and parameters. They explore tests, regulation, and efficiency.	8, 12	tical, ıework, Quiz, n
3. D.C. Machines: Students study construction, commutation, and armature reaction in D.C. machines. They learn about D.C. generators, including voltage regulation and load characteristics, and D.C. motors with torque-speed characteristics. They learn to size D.C. machines for specific applications.	11, 12	tical, ıework, Quiz, n
4. Excitation of D.C. Machines: Students learn excitation methods and different field windings' impact on performance. They understand excitation's importance for motor characteristics and generator output.	2	tical, ıework, Quiz, n
5. Application Analysis: Students analyze and evaluate D.C. machines for different applications. They gain practical knowledge in sizing machines based on torque, speed, and power requirements. They select appropriate machines based on understanding their characteristics and performance.	3, 12	tical, ıework, Quiz, n

EEE 393: Project Lab. 1

Catalog Description: The Electrical and Electronic Engineering Project Laboratory I course offers students the opportunity to work on real-world engineering projects. Students engage in team-based projects involving various electrical and electronic components and technologies. They learn project management skills, prototyping, testing, and documentation. The course fosters creativity, critical thinking, and problem-solving abilities. Students develop engineering skills and competencies, preparing them for professional careers and advanced project-based courses.

rse Learning Outcomes (CLO): Upon successful pletion of the course, students will be able to:		**ssment Tools**
1. Applying theoretical knowledge to real-world projects.	, 11, 12	tical, Homework,
2. Designing and implementing electrical and electronic engineering projects.	, 12	tical, Homework, , Exam
3. Analyzing and interpreting data from experiments.	3, 12	tical, Homework,
4. Collaborating effectively in teams.		ıework
5. Demonstrating professional ethics in laboratory work.	10	tical

Second Semester Courses

FEG 322: Engineering Mathematics IV

Catalog Description: Engineering Mathematics IV is an advanced undergraduate course that focuses on calculus, differential equations, linear algebra, and numerical methods. Students will develop a mathematical toolkit to solve complex engineering problems, emphasizing mathematical modeling and critical thinking. Topics include advanced calculus, differential equations, linear algebra, numerical methods, and engineering applications. Prerequisites include Calculus I and II, Differential Equations, and Linear Algebra. Assessment methods include assignments, quizzes, exams, and possibly a project or presentation.

rse Learning Outcomes (CLO): Upon successful completion of the se, students will be able to:		**ssment ls**

)ply advanced calculus techniques to solve engineering problems lving functions of several variables, vector calculus, and multiple grals.	1	nework, Quiz, n
alyze and solve differential equations, including first-order and second- r linear differential equations, using appropriate mathematical techniques.	3	nework, Quiz, n
rform operations on matrices, solve systems of linear equations, and apply r algebra concepts to engineering problems.	6	nework, Quiz, n
ilize numerical methods to approximate solutions for mathematical lems encountered in engineering practice.	6, 11	nework, Quiz, n
rmulate mathematical models to represent engineering systems and yze their behavior using appropriate mathematical tools.	3, 6	nework, Quiz, n

EEE 326: Analogue Electronic Circuits I

Catalog Description: The course "Analogue Electronic Circuits I" is an introductory course that covers the basics of analog electronic circuits. It starts with diode models and circuits, including rectifiers, clippers, clampers, switches, and voltage multipliers. The course then moves on to BJT circuits, covering circuit configurations, biasing methods, and small-signal amplifiers. FET circuits are also studied, highlighting their unique characteristics and applications. Power amplifiers, including their classifications and design considerations, are covered. Finally, oscillator circuits, such as RC, LC, crystal, and Wien-bridge oscillators, are explored, focusing on principles of oscillation and stability analysis.

rse Learning Outcomes (CLO): Upon successful completion of the se, students will be able to:		**ssment ls**
ode Circuits: Students learn about diode models and their use in fiers, clippers, clampers, switches, and voltage multipliers.	,12	nework, Quiz, n
T Circuits: Students explore circuit configurations with bipolar tion transistors (BJTs), including biasing methods and analysis of le-stage and multi-stage amplifiers.		nework, n
T Circuits: Students study field-effect transistors (FETs), their iguration, biasing techniques, and characteristics, comparing them BJTs.	,6	nework, n
wer Amplifiers: Students gain knowledge about different classes of er amplifiers (A, B, AB, C) and their operation, considering factors efficiency and power output.		nework, Quiz, n
cillator Circuits: Students explore various oscillator circuits (RC, LC, tal, Wien-bridge), understanding principles of oscillation, design, and uency/stability characteristics.	,12	, Project, n

EEE 332: Communication Principles

Catalog Description: The Communication Principles course covers a range of topics including basic concepts, analog modulation, pulse modulation, pulse code modulation, digital modulation, spread spectrum technology, TV broadcasting, and digital broadcasting. Students learn about the electromagnetic spectrum, noise, analog modulation techniques, pulse modulation, pulse code modulation, digital modulation techniques, and spread spectrum technology. The course also covers TV broadcasting, including black and white TV, color TV, and digital broadcasting.

rse Learning Outcomes (CLO): Upon successful completion of the se, students will be able to:		**ssment ls**

derstand and apply communication principles in engineering, including sage encoding, decoding, effective listening, and non-verbal munication.	, 3, 4	ework, Quiz, n
velop clear and concise oral communication skills for engineering entations, including organizing information, using visual aids, and ting to diverse audiences.	3, 5	ework, Quiz, n
hance written communication skills for technical documents in neering, such as reports, proposals, and memos, focusing on coherence, ture, and professionalism.	3, 4	ework, Quiz, n
ltivate teamwork and interpersonal communication skills for successful boration in engineering projects, including conflict resolution, active ning, feedback, and effective group discussions.		ework, Quiz, n
alyze and evaluate communication practices in engineering, considering s, cultural diversity, and the impact of communication technologies. tify barriers and propose improvements to enhance communication ctiveness.	3, 4, 8	ework, Quiz, n

EEE 344: Electromechanical Devices and Machines II

Catalog Description: Electromechanical Devices and Machines II is an advanced course that builds upon the foundational knowledge gained in Electromechanical Devices and Machines I. The course focuses on the study of A.C. machines, specifically polyphase induction machines and elementary synchronous machines, and their applications in electromechanical energy conversion.

rse Learning Outcomes (CLO): Upon successful completion e course, students will be able to:		**ssment Tools**
derstand advanced principles of electromechanical devices.	3	ework, Quiz, n
alyze and design complex electromechanical systems.	3	ework, Practical, , Exam
ply advanced control techniques to electromechanical devices systems.	3,12	ework, Practical, , Exam
rform modeling and simulation of electromechanical systems.	3,12	ework, Project, n
velop practical skills in troubleshooting and maintaining romechanical systems.	3	tical, Homework

EEE 352: Introduction to Power Systems

Catalog Description: Introduction to Power Systems is a comprehensive course that covers various aspects of electrical power systems. It starts with the representation and analysis of power systems, including equations and analysis techniques. Load flow studies are explored, focusing on understanding power flow and its influencing factors. Power station types, operation, and economics are discussed, along with auxiliary systems. Substations, power factor correction, polyphase theory, and DC/AC power distribution concepts are introduced. Network calculations cover power losses and voltage drop. Other topics include overhead lines, corona effect, voltage control, circuit breakers, load forecasting, and generating plant siting. Students will gain knowledge about power system stability, reliability, efficiency, planning, and operation challenges.

rse Learning Outcomes (CLO): Upon successful completion of the course, ents will be able to:		**ssment ls**

1. Power System Representation and Analysis: Students learn how to model and analyze power systems, solving problems and ensuring efficient power distribution.	3	nework, Quiz, n
2. Power Station Operations and Economics: Students gain knowledge about power station operations, considering factors like fuel costs, efficiency, and environmental impacts.	3,7,8	nework, n
3. Power Distribution and Network Calculations: Students study DC and AC power distribution principles, optimizing power distribution networks and voltage control techniques.	3,7	nework, n
4. Equipment and Components: Students explore power system components like overhead line conductors and circuit breakers, focusing on safety and protection.	3,7	nework, Quiz, n
5. Load Forecasting and Generating Plant Siting: Students learn load forecasting techniques and how to choose optimal locations for power generation facilities, considering various factors.	3,7,	nework, n

EEE 362: Linear Systems

Catalog Description: The Linear Systems course teaches students about principles and analysis techniques of linear systems across different domains. It covers mathematical models of physical systems and their electrical, mechanical, and thermal counterparts. The course emphasizes feedback control systems and their benefits for achieving desired system behavior. Students learn about transfer functions, block diagrams, and signal flow graphs as tools for system analysis and design. The course covers transient response, root-locus methods, and frequency response analysis using Bode and polar plots. Stability assessment through the Bouth and Nyquist criteria is also included. Students gain hands-on experience with analog computer simulation and Fourier transforms for signal analysis. Time domain models, Laplace transforms, Hilbert transforms, and Z-transforms are explored, focusing on their application in system analysis, difference equations, and frequency response.

rse Learning Outcomes (CLO): Upon successful completion of the se, students will be able to:		**ssment Tools**
athematical Modeling: Students learn to develop mathematical models physical systems and represent them using equations and transfer tions.	3,	nework, Exam
stem Analysis: Students analyze linear systems using block diagrams signal flow graphs, focusing on feedback control systems and transient onse analysis.	3, 12	ect, nework, Exam
equency Response Analysis: Students study the frequency response of ems using Bode and polar plots, considering stability criteria and its act on system performance.	3	nework, Exam
urier Transforms: Students explore Fourier transforms of periodic als and their frequency spectra, applying them to analyze system vior in the frequency domain.	3	nework, Exam
me Domain Models: Students delve into discrete-time systems, uding unit-sample response, convolution, correlation, Laplace sforms, Hilbert transforms, Z-transforms, and stability analysis in the Z-ain.	3,	nework, Quiz, n

EEE 372: Instrumentation and Measurements

Catalog Description: Instrumentation and Measurements is a comprehensive course that teaches students the principles and techniques of measuring and monitoring systems. It covers topics like meters, instrument

transformers, bridges, digital instruments, waveform generators, data acquisition systems, and transducers. Students learn about different types of meters, their applications, and operating principles. Instrument transformers like current and voltage transformers are discussed for accurate measurements. Bridges like the Resistance Bridge and Strain Gauge Bridge are explored for precise measurement of components. Digital instruments like R-L-C meters, multimeters, and oscilloscopes are covered for voltage, current, and impedance measurements. Waveform generators, pulse generators, and waveform analyzers are studied for signal generation and analysis. Counters, time-base circuits, and data acquisition systems are taught, including A/D and D/A converters and sample and hold circuits for accurate signal sampling. The course also covers various transducers for measuring speed, pressure, and temperature, explaining their working principles and applications.

rse Learning Outcomes (CLO): Upon successful completion of the course, ents will be able to:		**ssment ls**
pply fundamental concepts and principles of instrumentation and surements to design and analyze measurement systems.	3	ework, Exam
monstrate proficiency in selecting and utilizing appropriate instruments, ors, and measurement techniques for various engineering applications.	3,12	, Exam
sign and implement calibration procedures to ensure accuracy and reliability easurement systems.	3,12	ework, Exam
aluate and analyze measurement data using statistical methods and niques to assess system performance and make informed engineering sions.	3,12	ework, Exam
mmunicate effectively and professionally, both orally and in writing, about umentation and measurement concepts, system designs, and experimental ts.	**3,12**	**z, Exam**

FEG 3XX: Engineering Statistics

rse Learning Outcomes (CLO): Upon successful completion of the course, ents will be able to:		**ssment ls**
easurement Techniques: Students learn about various measurement uments like meters, voltmeters, ammeters, and wattmeter. They understand ument transformers and resistance/strain gauge bridges for measurements.	6, 9	ework, tical, Quiz, n
idge Circuits: Students study capacitive and inductive bridge circuits for suring capacitance and inductance. They learn different bridge igurations and their applications.	9	ework, tical, Quiz, n
gital Instruments: Students explore digital instruments like R-L-C meters, imeters, oscilloscopes, waveform generators, and more. They learn their ation and how to use them accurately.	9	ework, tical, Quiz, n
ta Acquisition Systems: Students are introduced to analog and digital data isition systems, A/D and D/A converters, and sample and hold circuits. They how to interface instruments with data acquisition systems.	9	ework, tical, Quiz, n
ansducers: Students study transducers for measuring physical quantities such peed, pressure, and temperature. They learn their working principles, ications, and how to select appropriate transducers.	9	ework, tical, Quiz, n

EEE 392: Laboratory Practical

rse Learning Outcomes (CLO): Upon successful completion of the course, ents will be able to:		**ssment ls**

agnetic Circuits: Students learn electromagnetism laws, B-H curves, and the fficance of magnetic materials. They study electromagnets, permanent nets, relays, and actuators.	, 6, 12	ework, tical, Quiz, n
ansformers: Students understand ideal transformers, equivalent circuits, ysis techniques, and parameters. They explore tests, regulation, and iency.	8, 12	tical, ework, Quiz, n
C. Machines: Students study construction, commutation, and armature ion in D.C. machines. They learn about D.C. generators, including voltage lation and load characteristics, and D.C. motors with torque-speed acteristics. They learn to size D.C. machines for specific applications.	11, 12	tical, ework, Quiz, n
citation of D.C. Machines: Students learn excitation methods and different windings' impact on performance. They understand excitation's importance notor characteristics and generator output.	2	tical, ework, Quiz, n
plication Analysis: Students analyze and evaluate D.C. machines for rent applications. They gain practical knowledge in sizing machines based orque, speed, and power requirements. They select appropriate machines d on understanding their characteristics and performance.	3, 12	tical, ework, Quiz, n
agnetic Circuits: Students learn electromagnetism laws, B-H curves, and the fficance of magnetic materials. They study electromagnets, permanent nets, relays, and actuators.	, 6, 12	ework, tical, Quiz, n

EEE 394: Project LAB II

Catalog Description: Project LAB II is an advanced course in electrical and electronic engineering that focuses on hands-on experience in designing, building, and marketing projects. Students work on solar, remote-controlled, and RF or Infrared-based systems. They learn project design principles, material selection, implementation, testing, and marketing. The course emphasizes practical skills and the entire project lifecycle. Students gain insights into problem identification, feasibility analysis, project planning, and troubleshooting. They also explore entrepreneurship and learn how to bring a project to the market. The course provides valuable experience and skills applicable in various engineering domains. Specific projects may vary.

rse Learning Outcomes (CLO): Upon successful pletion of the course, students will be able to:		**ssment Tools**
plying theoretical knowledge to real-world projects.	, 11, 12	tical, Homework,
signing and implementing electrical and electronic neering projects.	, 12	tical, Homework, , Exam
alyzing and interpreting data from experiments.	3, 12	tical, Homework,
llaborating effectively in teams.		ework
monstrating professional ethics in laboratory work.	10	tical

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400 Level Courses

EEE 495: Project Lab 111

Catalog Description: Project Lab III in conjunction with a specific application always provides enthusiasm for the students in developing basic electrical and electronic systems for home use and industrial applications. It focuses on simple electrical and electronic projects with Printed Circuit Board (PCB) layouts that are helpful for engineering students to do mini-projects. Knowledge gained from this course will help the students in dealing with complex circuits during their final year project selection and beyond.

rse Learning Outcomes (CLO): Upon successful completion of the se, students will be able to:		**ssment Tools**
pply proteus integrated development environment (IDE) in the design and lopment of projects		nework, Project, n
sign a specific project that can be controlled remotely.	2	nework, project
plement projects using Arduino microcontroller	12	nework, Project
derstand the developmental process of a printed circuit board (PCB)	5,	nework, zes, Exam
ply various testing methods on a system	5	nework, Project
velop a BEME for a specific project		nework, Project, n

EEE 471: Control and Instrumentation Engineering 1

Catalog Description: This course provides an all-encompassing understanding of the analysis and design of feedback control systems used in many engineering applications in Enugu state and beyond.The course leverages the knowledge of system developmental tools such as modeling, simulation, and analysis to study the behavior of control systems in both time domain and frequency domain. Also, the course tends to provide an understanding of measurement principles, terminologies, and the basic operation of commonly used instrumentation systems with reference to locally available industrial control systems hence offering the needed manpower for improved supervision of the many low and middle level technicians in Enugu State as well as quality control and assurance.

rse Learning Outcomes (CLO): Upon successful completion of the se, students will be able to:		**ssment s**
sign control systems with a focus on servo-mechanisms.	,12	nework, ect
odel relevant control systems using block diagrams and transfer functions		nework, ect
monstrate control systems response in both transient state and steady state onse.	12	nework, ect
velop knowledge of instrumentation and the ideal characteristics and dards	12	nework, ect, Exam
pply MATLAB software in modeling, simulation, and analysis of control ems	2,	nework, ect

ENS 401: Entrepreneurial Studies

Catalog Description: This course is focused on exposing students to the skills that will lead them to successful entrepreneurship in the emerging macroeconomic environment. The course is partly case-oriented and students will be expected to engage in small group projects and also visit successful business organizations and understand the secret of their success. It provides the students with an understanding of the key factors that influence the location of a manufacturing plant by an entrepreneur.

rse Learning Outcomes (CLO): Upon successful completion of the se, students will be able to:		**ssment Tools**
1. Develop heuristic knowledge on entrepreneurship	4	nework, Quizzes, n
2. Enumerate the entrepreneurial functions	4,	nework, Quizzes, n
xplain factors that influence the layout of a business	4	nework, Quizzes, n

velop entrepreneurial skills	,11	nework, project
plain the functions of management planning, organization, controlling, ing and directing		nework, Quizzes, n
evelop skills to manage small businesses	1,12,	nework, Quizzes, n
7. Analyze the roles of the Chief Executive and Board in policy formulation and implementation.	,	nework, Quizzes, n

EEE 433: Digital Communication

Catalog Description: EEE 433provides a comprehensive study of telecommunications systems with opportunities for applied research. It is designed to train students in acquiring knowledge about the design and implementation of these Digital Communications systems, which is in line with the ESUT vision in ensuring the development of quality manpower that will utilize technology for the service of the society at large. The course studies the basic concepts of digital communication systems. The aim is to provide understanding and implementation of the basic digital communication techniques with the help of theoretical and practical problem solving. The understanding of the basic digital communication techniques are the building blocks of the larger and more complex communication systems.

rse Learning Outcomes (CLO): Upon successful completion of ourse, students will be able to:		**ssment Tools**
1. Appreciate the application of digital communication in globalization	5	nework, Exam
2. Identify digital communication channels and the effect of noise on these channels	3	nework, Quizzes, Exam
3. Perform the time and frequency domain analysis of the signals in digital communication ems.		nework, Quizzes, Exam
4. Design a suitable source and channel coding scheme for a communication system.	2	nework, project, Exam
5. Design a simple digital communication network	12	nework, Project, Exam
6. Perform the time and frequency domain analysis of the signals in digital communication systems	3	nework, Quizzes, Exam
7. Develop a certain level of proficiency in concept of Digital modulation, multiplexing and spread spectrum techniques	3	nework, Project, Exam
8. Design and implement different modulation and demodulation techniques	12	nework, Project

EEE 445: Electrical Machines 1

Catalog Description: An electrical machine is a device which converts mechanical energy into electrical energy or vice versa. The basic design of an electrical machine involves the dimensioning of the magnetic circuit, electrical circuit, insulation system etc., and is carried out by applying analytical equations.

This course provides students with the technical knowledge and skills necessary to work with electric machines. It encompasses theories and operating principles of transformers, motors, and generators. Specifically, it focuses on the connection, installation, troubleshooting, and repair of transformers, motors, and generators. Students would be trained on energy conversion systems and some theories relating machine design principles. The training will equip students on the required knowledge and skills for machine design of all types. Enugu state needs locally designed machines and this course is a foundation to achieve that**.**

rse Learning Outcomes (CLO): Upon successful completion of the se, students will be able to:		**ssment Tools**

1. Explain the fundamental working principles of electric machines	3,	nework, Quizzes, n
)evelop the dynamic equation of single excited electro-mechanical em		nework, project
etermine by experiment the various speed control of DC machines		nework, Project
Construct a single-three phase transformer and characteristics of meters from three single phase transformer		nework, Quizzes, n
arry out experiment on energy conversions		nework, Project
7. Demonstrate the type of wiring arrangement of machines	7,8	nework, Project, n
8. Derive the emf equation of the synchronous machine with concentrated winding and full pitch winding	5,	nework, Project

EEE 461: Computer Aided Design for Electrical and Electronic Engineering

Catalog Description: The objective of the course sequence is to provide the student with practice in analytical and computer-aided design procedures for electrical engineering. CAD enables these engineers to create electrical and electronic diagrams, control circuit diagrams, schematics and documentation. CAD typically comes with libraries of parts and symbols which allow electrical engineers to automate design tasks and generate bills of materials. The particular objective of this course is to enhance the development of the student in the use of the general-purpose digital computers and the use of CAD programs in the solution of basic circuits for analysis and design, and the use of currently available engineering support software in the School of Engineering Computer-Aided-Design (CAD) Laboratory.

rse Learning Outcomes (CLO): Upon successful completion of the se, students will be able to:		**ssment Tools**
1. Develop heuristic knowledge on application of elementary numerical analysis techniques to basic circuits	3	nework, Quizzes, n
2. Apply selected programs and library subroutines for basic circuit analysis and design	5	nework, Quizzes, n
)evelop a series of utility programs to be used for CAD throughout all or in EEE courses	12	nework, Quizzes, n
3. Deploy software tools in analyzing, designing and simulation of electrical machines	3,	nework, Project, n
est and carry out fault diagnosis of electronic circuits		nework, project

EEE 499: SIWES III

Catalog Description: The objective of the course sequence is to provide students with practical experience in the field of electricity. Individual students in the program will be placed in a private or public firms: This program is designed to provide students with technical knowledge, skills, and proper work habits/attitudes necessary for employment in this field. The program prepares students to work and advance in their careers in positions such as electronic maintenance personnel, electrical maintenance personnel or power distribution personnel. The training agreement will be made between the employer, the students and the college that will integrate the students' learning objective into the training program to enhance the student's skills.

rse Learning Outcomes (CLO): Upon successful completion of the se, students will be able to:		**ssment ls**
emonstrate proper employee behavior and work habit	3,	n
erform task in the field of electrical/Electronic technology as assigned supervisor	3,12	n

EEE 451: Electrical & ICT Services Design and Installation

Catalog Description: This course aims enables students to learn electrical blueprint reading while simultaneously gaining exposure to and familiarity with the applicable sections of the most recent National Electrical Code (NEC), Regulation-IEE, NSE, and Nigeria standard. It focuses on imparting fundamental electrical concepts and practical skills essential for the workplace. The course covers basic safety practices for handling electrical work, proper usage of basic electrical and electronic hand tools, choice of cables, electrical devices and protections. The course integrates both theoretical and practical aspects, combining concepts related to electrical theories with practical information commonly encountered in electrical and electronic work. By blending these concepts, students receive comprehensive training that prepares them for real-world electrical tasks.

rse Learning Outcomes (CLO): Upon successful completion of the se, students will be able to:		**ssment ls**
1. Develop heuristic knowledge on basic electrical and electronic installations	3	nework, zes, Exam
2. Apply simulations on recommended Integrated development platforms		nework, zes, Exam
3. Develop Printable Circuit Boards	7,8	nework, zes, Exam
4. Develop a roadmap for electrical and electronic and ICT infrastructure migration	.1	nework, ect
5. Conduct a typical residential site wiring	,8	nework, ect, Exam
6. Design of electrical installation-Domestic, industrial, commercial air-conditioning	7	nework, ect

500 Level Courses

EEE 517: Intelligent Systems

Catalog Description:

This course is focused on big data processing. It provides an understanding of how Machine learning tools and algorithms are deployed to gather, analyze and respond to the data collected from the surrounding environment, such as to monitor and control a system or predict an event. The intelligent system can learn from experience and adapt according to current data. Knowledge of AI will help the students develop relevant systems and add-on Apps in Gaming, Natural Language Processing, Expert systems, and Vision systems.

rse Learning Outcomes (CLO): Upon successful completion e course, students will be able to:		**ssment Tools**
evelop heuristic knowledge in determining solutions to problems	3	nework, Quizzes, n
evelop a certain level of proficiency in coding languages such as on, C++, etc.		nework, Project
evelop simple relevant Machine Learning algorithms	2	nework, Project
etermine appropriate sensors for appropriate signal		nework, Quizzes, n
eploy MATLAB and Simulink tools in classification, regression, ering, etc.	12	nework, Project
evelop and apply simple standalone or add-on apps for big data essing	2	nework, Project

EEE 528: Solid-State Electronics

Catalog Description: This course provides an understanding of how diodes, transistors, and integrated circuits work. It studies the fundamental properties of semiconductor materials and devices. Properties of semiconductor materials such as Si, GaAs, and GaN will be introduced. Emphasis will be on how silicon wafer is produced since silica sand which is the raw material for Si production is common and locally available in Enugu state. The semiconductor material properties will be employed in the design of some relevant devices such as solar cells, photodetectors, LEDs, and microwave devices. Heterojunctions and nanostructures (such as quantum wells) will be introduced to improve semiconductor device performance. The course aims at providing students with the knowledge that exploits semiconductor properties, material selection, and approaches in device designs which is most relevant to the vast technical activities of the many artisans.

rse Learning Outcomes (CLO): Upon successful pletion of the course, students will be able to:		**ssment Tools**
1. Demonstrate an understanding of the key concepts involved in semiconductor device operation and their characteristics	3	nework, Exam
2. Perform simple analysis of semiconductor devices to derive basic I-V characteristics		nework, Project
3. Predict the effect of device design variations on device performance	2	nework, Project

4. Assess the relative advantages/disadvantages of different classes of electronic and optoelectronic devices for applications.		ıework, Quizzes, Exam
5. Design simple optoelectronic communication system	12	ıework, Quizzes, Exam
6. Demonstrate an understanding of the technologies used in integrated circuit manufacture and the impact of these technologies on device design and performance	?	ıework, Project

EEE 529: Advanced Circuit Techniques

Catalog Description: Each student in this course completes the paper design of several advanced circuits such as multiplexers, sample-and-holds, gain-controlled amplifiers, analog multipliers, digital-to-analog or analog-to-digital converters, and power amplifiers. One of each student's designs is presented to the class, and one may be built and evaluated. Associated laboratory assignments emphasize the use of modern analog building blocks.

rse Learning Outcomes (CLO): Upon successful completion of the se, students will be able to:		**ssment Tools**
ntify integrated operational amplifiers and advanced circuits	3	ıework, zes, Exam
derstand the design techniques for advanced analogue circuits aining transistors and operational amplifiers		ıework, ect
ild and simulate analogue circuits and perform measurements with ronic test equipment	?	ıework, ect
rite technical reports using collected data.		ıework, zes, Exam
alyze and design Waveform Generators, Voltage Multipliers and e locked loops	12	ıework, ect

EEE 532: High Frequency and Microwave Electronics

Catalog Description: Specifics of circuits used at high frequencies, distributed parameters. Analysis of transmission line, impedance matching. Passive and active microwave networks. Microwave semiconductor devices, diodes, transistors. Nonlinear networks, amplifiers, oscillators.

rse Learning Outcomes (CLO): Upon successful completion of ourse, students will be able to:		**ssment Tools**
1. explain the notion of distributed parameters	3	ıework, Quizzes, n
2. state the types and characteristics of transmission lines		ıework, Project
3. derive transmission line parameters	?	ıework, Project
4. analyze a linear or linearized microwave network		ıework, Quizzes, n
5. explain the operating principles of microwave semiconductor devices	12	ıework, Project
6. show basic parameters of nonlinear networks	, 12	ıework, Quizzes, n

7. describe the principles of injection-locking of a microwave oscillator	), 12	ework, Quizzes, n
8. explain the operation of the mixer	), 12	ework, Quizzes, ct

EEE 535: Mobile and Wireless Communication

Catalog Description: The objective of this course is to give an introduction to the fundamentals of the wireless communications systems, the wireless network architectures, protocols, and applications. Topics of study include an overview of wireless communications and mobile computing systems, signal propagation characteristics of wireless channels, wireless channel modelling, frequency reuse/cellular/microcellular concepts, modulation techniques for wireless systems, diversity techniques, and multiple access techniques.

rse Learning Outcomes (CLO): Upon successful completion of the se, students will be able to:		**ssment Tools**
1. explain the concept and evolution of wireless communication	3	ework, Quizzes, n
2. identify the various cellular system generations and the		ework, Project
3. mechanism for capacity increase in a cellular system	2	ework, Project
4. explain the concept of radio wave propagation: large scale path loss model, small scale fading and shadowing		ework, Quizzes, n
5. describe various modulation techniques	12	ework, Project
6. discuss on the types of diversity techniques	, 12	ework, Quizzes, n
7. categorize the multiple access techniques and state their application areas	), 12	ework, Quizzes, n
8. solve practical problems in wireless communication	), 12	ework, Quizzes, ct

EEE 547: Electric Motor Drives

Catalog Description: Electric motor drives can be seen as the synthesis of electric machines, power electronics and feedback control. The main emphasis of this course is the physical understanding of electric machines, since especially feedback control is covered in-depth in other courses in the study program. Power electronics is seen only as a block, which is able to process electrical energy to the form that is necessary for the application. The following subjects are treated: repetition of basics from electrical engineering, magnetism, magnetic circuits and transformers, DC machines, AC machines and the use of space vectors in the mathematical description, synchronous machines, asynchronous machines, modelling and dynamic simulation of DC and AC machines, motor and drive selection.

rse Learning Outcomes (CLO): Upon successful completion of the se, students will be able to:		**ssment ls**
1. have an understanding of the physical foundation for electric machines and electromechanical energy conversion	3	ework, zes, Exam
2. have a basic physical understanding of the working principles for the most important DC- and AC machines		ework, ct
3. understand electric motor drives as the synthesis of electric machines, power electronics and feedback control	2	ework, ct

4. model and simulate electric motor drives (DC and AC machines)		ıework, zes, Exam
5. select the components of an electric drive system.	12	ıework, ect
6. develop skills of selecting and designing important elements of a drive system	, 12	ıework, zes, Exam
7. Understand dynamic representations of DC, Synchronous and Induction motor drives	, 12	ıework, zes, Exam
8. understand issues, and develop skills, of designing hierarchical torque, speed and position controllers for converter driven motor drive systems	, 12	ıework, zes, Project

EEE 553: Electrical Energy Conversion and Storage

Catalog Description: The course introduces the technical criteria for the design of efficient energy conversion processes and systems. It covers review of boilers and cycles, fuel and combustion calculations, and fundamentals of both traditional and emerging energy conversion processes and systems for production of thermal, mechanical, and electrical energy. Topics include fossil, biomass, nuclear fuels, wind, solar, geothermal and fuel cells. Mechanisms for storing energy generated from each of these systems are also studied. The course also discusses conversion of automobile, renovation of old fossil fuel fired plant, co-firing of opportunity fuel, waste to energy technology, emission, and economics of energy projects.

rse Learning Outcomes (CLO): Upon successful completion of the se, students will be able to:		**ssment Tools**
1. Have understood fully the scientific and design principles of various energy conversion, and will become proficient in engineering calculations of the performance and preliminary design of various energy conversion systems	3	ıework, zes, Exam
2. Analyze thermodynamic processes and power cycles to identify energy efficiency improvements and technological advancements		ıework, ect
3. Become familiar with the physics of the environmental issues, including the greenhouse effect and global climate change, and critique equilibrium model of combustion for the estimation of performance and emissions	2	ıework, ect
4. Evaluate and critique competing energy conversion technologies on an economic and efficiency basis		ıework, zes, Exam
5. Become knowledgeable with the basic principles of energy storage	12	ıework, ect
6. Create ideas and participate effectively in discussions involving energy-conscious decisions	, 12	ıework, zes, Exam

EEE 555: Electric Power Systems Engineering

Catalog Description: This Electrical Power System Engineering course includes content that covers Power System Design, Short Circuit Analysis, Coordination Studies, and Power Factor and Power

System Harmonic Analysis. It is designed to address all facets of industrial power generation and distribution systems, including system planning, equipment selection, specification and application, system grounding, harmonic control, and protection and conformity with electrical code requirements. This program will also cover many in-class examples and problems for a hands-on learning experience. A correctly functioning electric power distribution system is imperative for the maintenance, troubleshooting and competent operation of any power plant. The power distribution system contains high voltage utility circuit breakers, distribution transformers, main transformers, motor control centers, voltage switchgear, motors, and variable speed drives. Therefore, all individuals who are involved in working with such critical equipment must be aware of its uses and implications in their work environments

rse Learning Outcomes (CLO): Upon successful completion of the se, students will be able to:		**essment Tools**
1. Understand power system design and analysis	3	nework, zes, Exam
2. Evaluate harmonics and design harmonic filters		nework, Project
3. Implement coordination lessons and curves	2	nework, Project
4. Select and size power system components		nework, zes, Exam
5. Conduct short circuit studies	12	nework, Project
6. Design electrical power systems more efficiently	, 12	nework, zes, Exam

EEE 575: Digital Signal Processing

Catalog Description: The course covers theory and methods for digital signal processing including basic principles governing the analysis and design of discrete-time systems as signal processing devices. Review of discrete-time linear, time-invariant systems, Fourier transforms and z-transforms. Topics include sampling, impulse response, frequency response, finite and infinite impulse response systems, linear phase systems, digital filter design and implementation, discrete-time Fourier transforms, discrete Fourier transform, and the fast Fourier transform algorithms.

rse Learning Outcomes (CLO): Upon successful completion of the se, students will be able to:		**essment ls**
1. Demonstrate an understanding of basic discrete-time systems, linearity, time-invariance, stability, impulse response and discrete convolution.	3	nework, zes, Exam
2. Implement discrete time systems, recursive and non-recursive realizations.		nework, ect
3. Perform Z transform and finding the inverse Z transform including its properties.	2	nework, ect
4. Demonstrate an understanding of frequency analysis of both continuous and discrete signals.		nework, zes, Exam
5. Demonstrate an understanding of frequency response of linear time invariant systems.	12	nework, ect
6. Demonstrate an understanding of discrete Fourier transform, its properties and applications.	, 12	nework, zes, Exam
7. Design FIR and IIR digital filters.	12	nework, ect

8. Demonstrate an understanding of multi-rate signal processing.	, 12	ework, zes, Exam

EEE 582: Engineering Management

Catalog Description: This course includes group decision-making, the development of the individual, and the importance of communication and interpersonal skills in the engineering environment. Students gain an understanding of work preferences and personal interactions through self-analysis, experience and reflection. In addition, students are introduced to a range of business management topics including, but not limited to, contract law, competition law and professional ethics. Assessment is through group projects, presentations, a competitive engineering proposal, a performance review interview and a written exam.

rse Learning Outcomes (CLO): Upon successful completion of the se, students will be able to:		**ssment ls**
1. Develop an understanding of the breadth of management and legal aspects in engineering;	3	ework, zes, Exam
2. Identify cognitive and affective domain strengths and weaknesses;		ework, ect
3. Recognize dynamics of interpersonal communication and judiciously apply these skills in group collaboration;		ework, ect
4. Apply different formats to create works containing effective, clear communication;		ework, zes, Exam
5. Demonstrate ability to collaborate within a diverse group of people;	12	ework, ect
6. Evaluate and synthesize multiple information sources;	, 12	ework, zes, Exam
7. Assess client requirements and propose coherent feasible solutions;	, 12	ework, zes, Exam
8. Develop confidence dealing with uncertainty;	, 13	ework, zes, Exam
9. Employ a culture of professional development through reflection and peer-oriented learning; and	10	ework, zes, Exam
10. Demonstrate the attitude of life-long-learning	10	ework, zes, Exam

EEE 514: Circuit Theory II

Catalog Description: Circuit Theory II completes an introduction to the fundamental building block for all electrical and electronic devices: the circuit. Circuit Theory II completes the review of basic circuits by guiding the student through a thorough review of alternating current circuits including the RC, RL, and RLC circuits. The student will also be introduced to several electrical devices including capacitors, inductors, and transformers.

rse Learning Outcomes (CLO): Upon successful completion of the se, students will be able to:		**ssment ls**
1. Select the appropriate analysis methodology	3	ework, zes, Exam
2. Apply all the analysis methods,		ework, ect

3. competence to provide transfer functions, frequency response plots, impulse andstep response for different circuits,	2	ıework, ect
4. Construct the functions of simple circuits by interpretation of specifications.		ıework, zes, Exam
5. dentify different circuits	12	ıework, ect
6. Applytheoretical knowledge in performing the lab measurements	, 12	ıework, zes, Exam
7. Prepare simulation programs	, 12	ıework, zes, Exam
8. Organise presentation of your lab work	, 13	ıework, zes, Exam
9. a laboratory project using ICT means	10	ıework, zes, Exam

EEE 534: Communication Systems Engineering

Catalog Description: This course studies basic principles of communication theory as applied to the transmission of information. The course topics include: baseband signal transmission, amplitude, phase and frequency modulation, modulated waveform generation and detection techniques, effects of noise in analog communication systems, frequency division multiplexing. Digital Signals: sampling, aliasing, quantization and introduction to pulse code modulation.

rse Learning Outcomes (CLO): Upon successful completion of the se, students will be able to:		**ssment ls**
1. Learn mathematical analysis of non-linear modulated signals (e.g., frequency and phase modulated signals) using Bessel functions and series expansions to estimate their spectra.	3	ıework, zes, Exam
2. Learn mathematical formulation and analysis of stochastic signals.		ıework, ect
3. Study characteristics of communication channels. Learn basic modulation techniques for efficient transmission of signals over communication channels.	2	ıework, ect
4. Learn modulation techniques to counteract frequency-dependent limitations of transmission (attenuation, frequency-selective fading). Learn effects of noise on systems and signals.		ıework, zes, Exam
5. Learn to model complete communication systems including transmitter and receiver structures. Study bandwidth efficient communication techniques.	12	ıework, ect
6. Learn to formulate and analyze effects of noise on model communication systems and signal propagation.	, 12	ıework, zes, Exam
7. Learn how to use the measurements of AM and FM signals to extract signal characteristics (e.g., modulation indices), so that signal characteristics can be modified to conform to regulatory conditions.	, 12	ıework, zes, Exam
8. Study different amplitude- and frequency modulation systems, study their characteristics, power efficiency and limitations.	, 13	ıework, zes, Exam

Learn coherent and non-coherent coherent communication systems.		
9. Learn to conduct lab experiments with specialized test and measurement equipment to measure modulated signal characteristics in time- and frequency domains.	10	ıework, zes, Exam
10. Learn to measure modulation indices of modulated signals.	)	ıework, ect

EEE 536: Data Communication and Networking

Catalog Description: This course teaches the design and implementation techniques essential for engineering robust networks. Topics include networking principles, Transmission Control Protocol/Internet Protocol, naming and addressing (Domain Name System), data encoding/decoding techniques, link layer protocols, routing protocols, transport layer services, congestion control, quality of service, network services, Software Defined Networks (SDNs), programmable routers and overlay networks, wireless and mobile networking, security in computer networks, multimedia networking, and network management.

rse Learning Outcomes (CLO): Upon successful completion of the se, students will be able to:		**ssment Tools**
1. Focus on information sharing and networks.	3	ıework, zes, Exam
2. Introduce flow of data, categories of network, different topologies.		ıework, Project
3. To Focus on different coding schemes.	2	ıework, Project
4. Brief the students regarding protocols and standards.		ıework, zes, Exam
5. To give clear idea of signals, transmission media, errors in data	12	ıework, Project

EEE 539: Industrial Electronics Design

Catalog Description: Industrial Electronics is the study of devices, circuits, and systems primarily used in automated manufacturing and/or process control. Topics covered include solid-state devices for industrial applications, sensors, AC and DC motors, motor control circuits, and programmable logic controllers.

rse Learning Outcomes (CLO): Upon successful completion of the se, students will be able to:		**ssment Tools**
1. Explain the operation of commonly used input and output devices for discrete control in industrial manufacturing systems.	3	ıework, zes, Exam
2. Develop a relay ladder logic control circuit that would meet given sequential process control requirements.		ıework, Project
3. Analyze the operation of various solid state devices for industrial applications.	2	ıework, Project
4. Design and analyze selected industrial electronic circuits using operational amplifiers and linear integrated circuits.		ıework, zes, Exam
5. Design and analyze industrial electronic circuits using SCRs, TRIACs, and other thyristors.	12	ıework, Project

6. Classify different sensors used in automated manufacturing applications and explain their operation.		ıework, zes, Exam
7. Select the appropriate sensor given the parameters for a sensing application and integrate the sensor using effective design practices.	12	ıework, Project
8. Explain the operation and characteristics of the various types of DC motors.		ıework, zes, Exam
9. Analyze the operation of various types of DC motor control circuits.	12	ıework, Project
10. Explain the operation characteristics, and industrial applications of the various types of AC motors and AC motor drive systems.		ıework, zes, Exam
11. Analyze the characteristics, operation, and industrial applications of special-purpose motors.	12	ıework, Project
12. Classify various types of programmable logic controllers (PLC) and describe their characteristics, operation, and industrial applications.		ıework, zes, Exam
13. Explain the operation of commonly used input and output devices for discrete control in industrial manufacturing systems.	12	ıework, Project

EEE 537: Power Electronics and Devices

Catalog Description: The course focuses on presenting the fundamental concepts on conversion, control and monitoring of electric energy using power semiconductor devices. Methods for analyzing power electronic converters suitable for AC/DC, DC/DC and DC/AC electrical energy conversions are presented. Additionally, principles for designing power electronic converters, including their power semiconductors and passive elements are established. Computer-aided analysis and simulations of the electrical and thermal performance of power electronic converters is also among the course objectives. The application of power electronic converters in the fields of sustainable energy technologies such as electrified transportation, wind energy, solar power, and electrical energy storage are presented. Furthermore, application of power electronics for transmission, distribution and control in the future electric power grid is described.

rse Learning Outcomes (CLO): Upon successful completion of the se, students will be able to:		**ssment ls**
1. Describe the characteristics of power semiconductor devices and identify suitable switch choices for a given application.	3	ıework, zes, Exam
2. Analyze controlled and uncontrolled single- and three-phase rectifiers, and cycloconverters.		ıework, ect
3. Analyze DC-AC converters, and use pulse-width modulation techniques.		ıework, ect
4. Analyze DC-DC converters.		ıework, zes, Exam
5. Explain power electronic applications in power systems and motor drives, and evaluate suitable converter types of a given application.	12	ıework, ect

EEE 537: Power Electronics and Devices

Catalog Description: This course is a comprehensive undergraduate course on electromagnetic fields and waves. Topics covered include Maxwell's equations, electrostatics and magnetostatics, fields of charge distributions, fields near conductors, method of images, material polarization and dielectrics, fields of current distributions, electric and magnetic dipoles, power and energy in electromagnetism, electromagnetic work, electrodynamics, electromagnetic waves, wave polarization, wave propagation in isotropic and anisotropic media, wave propagation in plasmas, reflection, transmission, and refraction of waves at media interfaces, wave propagation in periodic structures and photonic bandgaps, guided waves in transmission lines, microwave circuits and smith charts, transients in transmission lines, metallic waveguides, dielectric waveguides, radiation and antennas, wire antennas, antenna arrays, diffraction, aperture antennas.

rse Learning Outcomes (CLO): Upon successful completion e course, students will be able to:		**ssment Tools**
understand the Theorem, Laws, Principle and their related lems over Static Electromagnetic Fields	3	nework, Quizzes, n
earn the basic laws in Static Magnetic Field and able to find ous parameters with elated problems		nework, Project
now how the Electric Field is applied in Dielectrics with various tions and ications	2	nework, Project
nderstand how the Magnetic field works with Ferromagnetic erials		nework, Quizzes, n
nalyze how the Time is Varying in both Electric and Magnetic ls with various vation	12	nework, Project
nderstand, and analyze the electromagnetic field distribution h forms the basis for advanced subjects related to romagnetic field.	9	nework, Quizzes, n

EEE 546: Electromechanical Devices Design II

Catalog Description: The objective of this course is to present the principles underlying electromechanical energy conversion by considering salient aspects of conversions, energy balance and magnetic field system. We shall in a progressive sequence, present all the important types of dc machines, covering their basic operation, general principles and characteristics, testing of dc machines, speed control and industrial applications of dc machines. We shall also present the principle of operation of transformers, construction and equivalent circuits, transformer tests, voltage regulation, three-phase transformers and connections, autotransformers, their applications and instrument transformers.

rse Learning Outcomes (CLO): Upon successful completion of the se, students will be able to:		**ssment ls**
1. Understand the fundamentals of electromagnetism (Maxwell's equations) and apply them to standard problems	3	nework, zes, Exam
2. Understand magnetic circuit analysis and use it to predict the electromagnetic characteristics of common devices		nework, ect

3. Understand finite element analysis for electromagnetic systems and use it to predict magnetic fluxes, forces, and torques in electric machine models	2	ıework, ect
4. Understand the fundamentals of permanent magnetism and be able to specify permanent magnet materials for specific applications		ıework, zes, Exam
5. Understand the principles of electromechanical energy conversion and use these principles to predict forces and torques in electric machine models	12	ıework, ect
6. Be able to develop nonlinear dynamic models of electric machines, simulate these systems using MATLAB and Simulink, and analyze their performance and response characteristics	9	ıework, zes, Exam
7. Understand the fundamentals (basic machine topology and construction, etc.) and basic operating characteristics (torque vs. speed, efficiency, etc.) of common electrical machines (induction motors, synchronous motors, DC motors, etc.)		ıework, zes, Exam
8. Be able to design, model, and simulate common (standard motors, etc.) and unique (railguns, active magnetic bearings, etc.) electric machines	10	ıework, zes, Exam

EEE 558: Switchgear and High Voltage Engineering

Catalog Description: The objective of this course is to present the principles underlying electromechanical energy conversion by considering salient aspects of conversions, energy balance and magnetic field system. We shall in a progressive sequence, present all the important types of dc machines, covering their basic operation, general principles and characteristics, testing of dc machines, speed control and industrial applications of dc machines. We shall also present the principle of operation of transformers, construction and equivalent circuits, transformer tests, voltage regulation, three-phase transformers and connections, autotransformers, their applications and instrument transformers.

rse Learning Outcomes (CLO): Upon successful completion of the se, students will be able to:		**ssment ls**
1. Conceptualize the idea of high voltage and safety measures involved.	3	ıework, zes, Exam
2. Analyze the breakdown mechanism of solids, liquids and gases.		ıework, ect
3. Analyze and calculate the circuit parameters involved in generation of high voltages.	2	ıework, ect
4. Measure direct, alternating and impulse high voltage signals.		ıework, zes, Exam
5. Measure the dielectric loss and partial discharge involved in non-destructive high voltage tests.	12	ıework, ect
6. Recognize the types and characteristics of medium and high voltage switchgears	9	ıework, zes, Exam
7. Explore the merits of eco efficient and eco-friendly switchgears		ıework, zes, Exam

8. Understand the merits of ester-based oils for transformers	10	ıework, zes, Exam
9. Appreciate the use of green gases for gas insulated substations and circuit breakers	9	ıework, zes, Exam
10. Achievement of well-maintained and safe switchgears for operations	10	ıework, zes, Exam

EEE 565: Power System Communication and Control

Catalog Description: Communication and control of power systems is a wide and comprehensive topic including many different engineering fields ranging from power system instrumentation to power system modelling and control systems theory. To manage and optimize the control and operation of the power system, information and control systems are used throughout the power system. Actually, the information and control systems are so tightly integrated with the physical power system, that together they constitute a cyber-physical system. This introductory course provides a wide perspective on the field of communication and control of electric power systems, opening for continued studies in specialized subjects. It goes beyond traditional analytical control systems or power system courses, and focuses on the practical implementation of systems for communication and control. The course is focused on design, implementation and use of information and control systems for control and operation of the physical power system. As a framework for the course, the Smart grids Architecture model - SGAM is used as a reference for the different aspects of communications and control in power systems.

rse Learning Outcomes (CLO): Upon successful completion of the se, students will be able to:		**ssment ls**
1. Describe the functions of the primary equipment in the power system that is relevant for protection, automation and control	3	ıework, zes, Exam
2. Construct a state estimator for power systems.		ıework, ect
3. Analyze substations and simple power systems in terms of reliability protection, automation and control needs.	2	ıework, ect
4. Describe relevant interoperability standards in the field, such as the IEC 61850		ıework, zes, Exam
5. Describe the function and architecture of information and control systems used for protection, automation and control of power systems.	12	ıework, ect
6. Analyze and develop basic information & control systems for system-wide control from control rooms, e.g., SCADA systems and EMS applications.	9	ıework, zes, Exam
7. Describe the function and architecture of communication systems used for information & control systems for power system control.		ıework, zes, Exam
8. Analyze and develop basic systems for substation automation and protection.	10	ıework, zes, Exam
9. Describe the importance of information & control systems for the ability to connect large amounts of renewable power sources.	9	ıework, zes, Exam

10. Describe the threats and risks associated with the use of information & control system for controlling the electric power system, known as Cyber Security	10	ework, zes, Exam

EEE 574: Control Systems Engineering II

Catalog Description: Introductory course in control theory: system modeling, simulation, analysis and controller design. Description of linear, time-invariant, continuous-time systems, differential equations, transfer function representation, block diagrams and signal flows. System dynamic properties in time and frequency domains, performance specifications. Basic properties of feedback. Stability analysis: Routh-Hurwitz criterion, Root Locus method, Bode gain and phase margins, Nyquist criterion. Classical controller design in time and frequency domain: lead, lag, lead-lag compensation, rate feedback, PID controller. Laboratory work consists of experiments with a DSP-based, computer-controlled servomotor positioning system, and MATLAB and Simulink assignments, reinforcing analytical concepts and design procedures.

rse Learning Outcomes (CLO): Upon successful completion of the course, nts will be able to:		**ssment s**
1. Demonstrates competency in modeling and analysis of a SISO, continuous, LTI control system in a single feedback loop configuration, including specific tasks of defining a system analytical description, its stability and its dynamic response. Uses relevant computer simulation software, MATLAB and Simulink. Identifies and carries out steps required in performing system stability and dynamic response analysis.	3	ework, zes, Exam
2. Implements a PID controller on a real-time control system (servomotor), including obtaining		ework, ect
3. experimental data. Applies the control theory learned to predict performance of the PID controlled servomotor.	2	ework, ect
4. Describes the differences between theoretical (linear) model and the implemented design on a real-life system. Assesses accuracy of the results, verifying experimental data and explaining sources of possible discrepancies.		ework, zes, Exam
5. Identifies and carries out steps required in designing an in-the-loop controller (PID and Lead-Lag) for a low order LTI system in order to meet a set of specifications.	12	ework, ect
6. Evaluates the chosen controller design by verifying its performance against a set of criteria, is able to explain differences between expected and actual results.	9	ework, zes, Exam
7. Demonstrates proficiency in the use of high-performance engineering modeling and analysis software, including MATLAB, Control Systems Toolbox and Simulink, for control system analysis and design, in this course and for subsequent engineering practice.		ework, zes, Exam
8. Accomplishes several tasks requiring efficiency in managing own time and tasks to achieve individual and team goals, including meeting various deadlines.	10	ework, zes, Exam
9. Produces a professionally prepared technical report using appropriate format, grammar, and citation styles, with figures and	9	ework, zes, Exam

	tables chosen to illustrate points made, with appropriate size, labels and references in the body of the report. Reports are graded on correctness, completeness, grammar, quality of graphics and layout.		

EEE 576: Reliability Engineering

Catalog Description: The objective of the course is to provide the students with the fundamental concepts, the necessary knowledge and the basic skills related to systems reliability and systems maintenance function. The course intends to expose the students to the concept of reliability and to help them learn the techniques of estimating reliability and related characteristics of components/ systems. It covers reliability data analysis using distributions such as Weibull analysis, Mean time to failures, Mean time between failures, Mean time to repair and their impacts on reliability, availability and maintainability. Moreover, it exposes them to the necessary engineering techniques used for analyzing, planning and controlling maintenance systems.

rse Learning Outcomes (CLO): Upon successful completion of the se, students will be able to:		**ssment s**
1. Associate various mathematical concepts to calculation techniques for reliability problems.	3	ework, zes, Exam
2. Distinguish where computer software can be used for studying problems in reliability.		ework, ect
3. Outline the study of mathematical techniques for preventive replacement analysis.		ework, ect
4. Analyze reliability data, including burn-in, random and wear out failures, and how to take into account those items which have not failed.		ework, zes, Exam
5. Estimate key parameters such as Mean Time Between Failures (MTBF) and the estimation of confidence limits.	12	ework, ect
6. Determine preventive replacement policy.	9	ework, zes, Exam
7. Evaluate reliability, availability and maintainability intervention options.		ework, zes, Exam

EEE 576: Reliability Engineering

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

rse Learning Outcomes (CLO): Upon successful completion of the se, students will be able to:		**ssment s**

1. describe and explain the basic concept, sources and aspects of law;	3	ıework, zes, Exam
2. describe and explain the major differences between the various categories of law, courts and legal jurisdictions;		ıework, ect
3. describe and explain legal principles and their application in professional engineering design and management services and their professional liability implications; and	9	ıework, zes, Exam
4. develop reasoned analysis of real-life or hypothetical engineering scenarios using the legal principles to 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.		ıework, zes, Exam

EEE 595: Digital System Design with VHDL

Catalog Description: The course will advance student skills in designing digital systems with Programmable Logic Devices (PLD), such as Field Programmable Gate Arrays (FPGA). FPGAs are applied in a wide range of areas such as digital signal processing, video and image processing, vehicle control, aerospace engineering, military applications and artificial intelligence. FPGA is a flexible, widely used platform for rapid prototyping. Using FPGAs for designing hardware has proved to be a good approach to balance and reduce the time required for implementation and prototyping. FPGA-based design requires the skills of special design methods and the use of professional CAD systems. The course is highly technological and based on specialized software and hardware. Students learn the Verilog Hardware Description Language and master the FPGA design process using Intel Quartus Prime Design software. The course labs are based on TERASIC evaluation boards with Intel / Altera FPGAs.

rse Learning Outcomes (CLO): Upon successful completion of ourse, students will be able to:		**essment Tools**
1. choose the most appropriate class of FPGA to solve a problem;	3	ıework, Quizzes, n
2. develop algorithms and implement them on FPGA using Verilog hardware description language		ıework, Project
3. perform modeling, optimizing and debugging for a FPGA-based module;	9	ıework, Quizzes, n
4. perform synthesis and analysis of testbenches for IP blocks using software and hardware tools.		ıework, Quizzes, n

EEE 599: Electrical & Electronic Engineering Project (6 Units)

rse Learning Outcomes (CLO): Upon successful completion of the se, students will be able to:		**essment ls**
pply advanced theoretical knowledge and practical skills in electrical and ronic engineering to independently design, analyze, and implement a plex engineering project.	he POs	ıework, tical, inar
monstrate proficiency in project management by planning, organizing, and uting the final year project within specified timelines and resource traints.	he POs	ıework, tical, inar

nduct comprehensive research, analysis, and critical evaluation of existing ature, technologies, and methodologies relevant to the chosen area of rical and electronic engineering project.	he POs	ework, tical, inar
mmunicate effectively through oral and written means, demonstrating the ty to present technical concepts, project findings, and design solutions to technical and non-technical audiences.	he POs	ework, tical, inar
hibit professional and ethical responsibility by adhering to relevant codes nduct, considering the social, environmental, and economic impacts of the ct, and ensuring the safety and reliability of the implemented solution.	he POs	ework, tical, inar