COURSE LEARNING OUTCOMES (CLOs)

The Course Learning Outcomes (CLOs) are distinct for each of the forty-one (43) courses within the programme. These outcomes are outlined in the respective course compacts for each course and are provided below.

BOWEN UNIVERSITY, IWO
Faculty of Engineering
Electrical/Electronic Engineering Programme

Course Number: EEE 201
Course Title: Engineering Mathematics 1
Semester: First
Credit Hours: 2 hours
Contact Hours: Lecture - Two hours of lectures per Week
Location: Alma Rohr
Lecturer(s): Engr Diarah. R. S.
Textbooks and other Materials:

1. *Advanced Engineering Mathematics* by Erwin Kreyszig
2. *Higher Engineering Mathematics* by B.S. Grewal
3. *Mathematics for Engineers* by Anthony Croft and Robert Davison

a) Course Overview and description

This course is a fundamental introduction to calculus and linear algebra, providing a strong mathematical foundation for various scientific and engineering disciplines. Through lectures, problem-solving exercises, and (potentially) projects, you will develop essential skills in:

b) Pre-requisites: Nil

c) Co-requisite(s): Nil

d) Role in Curriculum: Core

e) Course Learning Outcome (CLO) and Programme Outcomes (PO)

Course Learning Outcomes: upon successful completion of the course, students will be able to:	**Suitable Bloom Taxonomy Relevant to the CLOs**	**POs**	**Assessment Tools**
Explain the concept of limits and evaluate them using appropriate techniques	1,2	1, 2	Homework, quizzes and Exams
Illustrate basic functions and apply differentiation rules to solve optimization problems.	1, 2	1, 2	Homework, quizzes and Exams
Identify first-order linear differential equations with separable variables.	1, 2	1, 2	Homework, quizzes and Exams
Understand the concept of partial derivatives and apply them to analyze multivariable functions.	2, 3	1, 2	Homework, quizzes and Exams
Solve basic operations on matrices and solve systems of linear equations using determinants.	1, 2, 3	1, 2	Homework, quizzes and Exams
Describe basic vector operations (addition, subtraction, dot product, cross product).	1, 2	1, 2	Homework, quizzes and Exams
Apply vector algebra to solve geometric problems and analyze forces	1, 2, 3	1, 2	Homework, quizzes and Exams

f) Mapping of CLOs to relevant POs

Course Learning Outcomes	Programme Outcomes (POs)											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Explain the concept of limits and evaluate them using appropriate techniques	**3**	**3**										
Illustrate basic functions and apply differentiation rules to solve optimization problems.	**2**	**3**										
Identify first-order linear differential equations with separable variables.	**3**	**3**										
Understand the concept of partial derivatives and apply them to analyze multivariable functions.	**2**	**3**										
Solve basic operations on matrices and solve systems of linear equations using determinants.	**2**	**3**										
Describe basic vector operations (addition, subtraction, dot product, cross product).	**2**	**3**										
Apply vector algebra to solve geometric problems and analyze forces	**2**	**3**										

Keys: 1 = Slightly related, 2 = Moderately related, 3= Highly related

g) Expectations of Students

a. Attend 2 hours of lectures per week

b. Turn in assignments and projects as considered suitable by the tutors

c. Complete continuous assessment which involves mid-semester test

d. Complete a 2-hour comprehensive final examination at the end of the semester.

h) Methods of Lecture Delivery/Teaching Aids

Lecture Delivery Methods

Educator-Student Interaction (Discussion method) Video Tutorials Electrical systems

Teaching Aids

Visual Aids (Use of PowerPoint slides, Lecture templates-handouts)

i) Course Content or Outline

Topics	Weeks
Foundations of Calculus • Definition of limits and their properties • Techniques for evaluating limits (algebraic manipulation, L'Hopital's rule) • One-sided limits and continuity • Derivatives and their interpretation (rate of change) • Differentiation rules (product rule, quotient rule, chain rule) • Applications of differentiation (extrema, curve sketching) • Higher-order derivatives and their applications (concavity, inflection points) • Introduction to linear first-order differential equations (separation of variables)	1- 3
Multivariable Calculus • Functions of multiple variables and their graphical representation • Partial derivatives and their interpretation (marginal effects) • Techniques for finding partial derivatives. • Total derivatives and their relationship to partial derivatives • Differentiation of composite functions • Applications of multivariable calculus (optimization problems) • Introduction to vectors, vector addition, and scalar multiplication • The dot product and cross product of vectors • Geometric interpretation of vector operations	4 - 6
Linear Algebra and Applications • Matrix operations (addition, multiplication, transpose) • Introduction to determinants and their properties • Cramer's rule for solving linear systems of equations. • Solving systems of linear equations using Gaussian elimination • Eigenvalues and eigenvectors of matrices • Applications of matrices in engineering and physics (e.g., linear transformations) • Gradient vector and its interpretation • Directional derivatives and the directional derivative theorem	7 - 9
Advanced Topics • Line integrals, double integrals, and triple integrals (applications in physics and engineering) • Divergence, curl, and applications of vector calculus (Maxwell's equations) • Infinite series and Taylor series	10 -12
Lecture free week	13
Revision & Examination	14 - 15

j) Method of Grading Continuous Assessment

Continuous Assessment (Assignment)1:10 %
Continuous Assessment Test: 20%
End of Semester Examination: 70%

k) Tutorials

Tutorials are taken at the end of every module.

l) Term Paper and Assignments

Homework, quizzes and Test will be conducted.

m) Contemporary Issues and Industrial Relevance

Mathematics is the backbone of all engineering disciplines. Here's an exploration of how contemporary issues and industrial relevance intersect with engineering mathematics:

- **Contemporary Issues**
  - Developing increasingly complex and accurate models to simulate real-world engineering systems.
  - Incorporating uncertainty and variability into models for robust design and risk assessment.
  - Utilizing machine learning and artificial intelligence to enhance the capabilities of engineering models.
- **Industrial Relevance:**
  - Optimizing the design and performance of complex engineering systems like airplanes, bridges, and power grids.
  - Virtually testing products and processes to reduce development costs and improve safety.
  - Developing autonomous systems and robots with advanced decision-making capabilities.

BOWEN UNIVERSITY, IWO
Faculty of Engineering
Electrical/Electronic Engineering Programme

Course Code: EEE 202 **Course Title:** Engineering Mathematics II
Semester: Second **Credit Hours**: 3 hours
Contact Hours: Lecture - Three hours of lectures per Week
Location: Alma Rohrm **Lecturer(s)**: Dr. S. I. Ojo
Textbooks and other Materials:

1. *Engineering Mathematics* 7th Edition by K.A STROUD
2. *Advanced Engineering Mathematics* by H. K. Dass

a) Course Overview and description

This course explores advanced calculus techniques like solving second-order differential equations and applying line and multiple integrals. It then dives into complex analysis, introducing complex functions and their applications like transformation and mapping, along with special functions used in science and engineering.

b) Pre-requisites: EEE 201

c) Co-requisite(s): Nil

d) Role in Curriculum: Core

e) Course Learning Outcome (CLO) and Programme Outcomes (PO)

Course Learning Outcomes: upon successful completion of the course, students will be able to:	**Suitable Bloom Taxonomy Relevant to the CLOs**	**POs**	**Assessment Tools**
Solve second-order differential equations using various techniques.	1, 2, 3	1	Assignment, quizzes and Exams
Describe and solve line and multiple integrals to solve problems in physics and engineering	2, 3	1	Assignment, quizzes and Exams
Understand and apply the concept of differentiation of integrals.	2, 3	2, 3	Assignment, quizzes and Exams
Define complex numbers and analytical functions.	1, 2	3	Assignment, quizzes and Exams
Utilize transformation and mapping techniques using complex analysis.	1, 2, 3	2, 3	Assignment, quizzes and Exams
Apply special functions to solve problems in various scientific and engineering domains.	2, 3	1	Assignment, quizzes and Exams

f) Mapping of CLOs to relevant POs

Course Learning Outcomes	**Programme Outcomes (POs)**											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Solve second-order differential equations using various techniques.	**3**											
Describe and solve line and multiple integrals to solve problems in physics and engineering	**3**											
Understand and apply the concept of differentiation of integrals.		**2**	**3**									
Define complex numbers and analytical functions.		**3**										
Utilize transformation and mapping techniques using complex analysis.		**3**	**2**									

Keys: 1 = slightly related, 2 = moderately related, 3 = highly related

g) Expectations of Students

a. Attend 3 hours of lectures per week
b. Turn in assignments considered suitable by the tutors
c. Complete continuous assessment which involves mid-semester test
d. Complete a 3-hour comprehensive final examination at the end of the semester.

h) Methods of Lecture Delivery/Teaching Aids

Lecture Delivery Methods

Educator-Student Interaction (Discussion method and analogies)

Teaching Aids

Visual Aids (Use of Power Point slides, Lecture templates-handouts)

i) Course Content or Outline

Topics	Weeks
Second order differential equations: • Formation of second order differential equation • Solution of second order homogeneous differential equations • Solution of second order non-homogeneous differential equations • Solution of combined homogeneous and non-homogeneous second order differential equations	1- 3
Line Integral and Differentiation of integral: • Properties of line integral • Evaluate line integral along semi-circle • Evaluate line integral round a closed curve • Dependence of line integral on the path of integration	4 - 5
Multiple Integral: • Double integral • Triple integral • Integration of exact differentials • Green's Theorem	6 - 7
Analytical functions of complex variables: • Complex algebra and the complex plane • Zeros and poles • Cauchy's theorem and integral formular • Analytic and Harmonic function	8 - 9
Transformation and mapping: • Rigid transformations (rotations, reflections, and translations) • Non-rigid transformations (dilations and shears) • Transformation of translation • Vertical and Horizontal translation • Combine translation • Successive translation	10 -11
Special functions: • Bessel Function • Gamma function • Legendre Function	12
Lecture free week	13
Revision & Examination	14 - 15

j) Method of Grading Continuous Assessment

Continuous Assessment (Assignment): 10%
Continuous Assessment Test: 20%
End of Semester Examination: 70%

k) Tutorials

Tutorials are taken at the end of every module.

l) Term Paper and Assignments

This term paper challenges students to delve into advanced integration techniques with modeling and applications of complex analysis. The course also includes assignments designed to solidify student understanding through problem-solving and applications, analysis and interpretation, theoretical exploration, and applications.

m) Contemporary Issues and Industrial Relevance

This course covers a range of advanced mathematical concepts that have significant relevance to contemporary issues and industrial applications. Thereby equips students with a strong foundation for tackling contemporary issues and real-world challenges across a wide range of industries.

BOWEN UNIVERSITY, IWO
Faculty of Engineering
Department of Electrical/Electronic Engineering

Course Code: EEE 203
Course Title: Basic Electrical Engineering I
Semester: First
Credit Hours: 3 hours
Contact Hours: Lecture - Three hours lectures per Week
Location: Alma Rohm
Lecturer(s): Dr. S. I. Ojo
Textbooks and other Materials:

1. *B. L. Theraja & A. K. Theraja* (2008), A textbook of Electrical Technology
2. Basic Electrical Engineering: Digital Notes (2015), Malla Reddy Faculty of Engineering & Technology, India

a) Course Overview and description

This course provides a foundation in electrical circuits, exploring fundamental concepts, circuit elements, and analysis techniques. It explores historical context, electrostatics, and electrical components to analyze and design basic electrical circuits.

b) Pre-requisites: Nil

c) Co-requisite(s): Nil

d) Role in Curriculum: Core

e) Course Learning Outcome (CLO) and Programme Outcomes (PO)

Course Learning Outcomes: upon successful completion of the course, students will be able to:	**Suitable Bloom Taxonomy Relevant to the CLOs**	**POs**	**Assessment Tools**
Apply the basic RLC circuit elements and its concepts to networks and circuits.	2, 3	1	Assignment, quizzes and Exams
Describe the circuits by applying network theorems to solve them to find various electrical parameters.	1, 2	2, 5	Assignment, quizzes and Exams
Illustrate the single-phase AC circuits along with the concept of impedance parameters and power.	1, 3	1, 2	Assignment, quizzes and Exams
Understand the Constructional Details and Principle of Operation of DC Machines and Transformers	1, 2	2, 3	Assignment, quizzes and Exams
State different laws and theorems to solution of simple circuits.	1	1, 4	Assignment, quizzes and Exams

f) Mapping of CLOs to relevant POs

Course Learning Outcomes	Programme Outcomes POs:											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Apply the basic RLC circuit elements and its concepts to networks and circuits.	**3**											
Describe the circuits by applying network theorems to solve them to find various electrical parameters.		**3**		**2**								
Illustrate the single-phase AC circuits along with the concept of impedance parameters and power.	**2**	**3**										
Understand the Constructional Details and Principle of Operation of DC Machines and Transformers		**2**	**3**									
State different laws and theorems to solution of simple circuits.	**3**			**2**								

Keys: 1 = Slightly related, 2 = Moderately related, 3 = Highly related

g) Expectations of Students

a. Attend 3 hours of lectures per week
b. Turn in assignments and projects as considered suitable by the tutors
c. Complete continuous assessment which involves mid-semester test
d. Complete a 3-hour comprehensive final examination at the end of the semester.

h) Methods of Lecture Delivery/Teaching Aids

Lecture Delivery Methods

Educator-Student Interaction (Discussion method and analogies)

Teaching Aids

Visual Aids (Use of Power Point slides, Lecture templates-handouts)

i) Course Content or Outline

Topics	Weeks
Brief history of electrical engineering and review of basic electrostatics • Description of electric circuit resistors and capacitors in electric circuit • Analysis of inductors, mutual inductors, and transformers in electric circuit • Analysis of voltage and current sources	1 - 2
Network Theorem: • Identification of node and loop in electrical circuit • Kirchhoff's Voltage Law (KVL) and Kirchhoff's Current Law (KCL) • Thevenin theorem and Norton theorem, Superposition theorems	3 - 7
Power and Transient analysis in electric circuit: • Power and energy in electric circuits. • Periodic waveforms and their effective values • Single time constant circuits • Concepts of impedance and admittance • Resonant circuits	8 - 10
Magnetic circuits, Transformers and electrical machines: • Review of magnetic fields of currents in space • Magnetic flux and flux density • Transformers features and applications • Brief discussion of magnetic circuits • Direct Current (DC) motors and generators	11 - 12
Lecture free week	13
Revision & Examination	14 - 15

j) Method of Grading Continuous Assessment

Continuous Assessment (Assignment): 10%
Continuous Assessment Test 2 (Term paper): 20%
End of Semester Examination: 70%

k) Tutorials

Tutorials are taken at the end of every module.

l) Term Paper and Assignments

This term paper challenges students to delve into impact of a specific historical event on Electrical Engineering with in-depth analysis of a specific electrical circuit element and comparison of network theorems for circuit analysis. The course also includes assignments designed to solidify student understanding through problem-solving exercises, calculations, review and analysis of circuits.

m) Contemporary Issues and Industrial Relevance

This course equips students with a strong foundation in electrical engineering principles, which are applicable to a vast array of contemporary issues and have significant relevance across various industries. By building this foundation, graduates are prepared to tackle the challenges and contribute to advancements in the ever-evolving field of electrical engineering.

BOWEN UNIVERSITY, IWO
Faculty of Engineering
Department of Electrical/Electronic Engineering

Course Number: EEE 204 **Course Title:** Basic Engineering II
Semester: Second **Credit Hours**: 2 hours
Contact Hours: Lecture - Two hours of lectures per Week
Location: Alma Rohm **Lecturer(s)**: Dr. A.S. Oluwole
Textbooks and other Materials:

a) Course Overview and description

This course builds upon foundational electrical engineering concepts and explores the principles and applications of various electronic devices. The course covers vacuum devices like diodes, triodes, tetrodes, and pentodes, along with biasing techniques. In addition, the course investigates semiconductor devices like p-n junction diodes, Zener diodes, and bipolar transistors, understanding their characteristics and practical uses in rectifiers, regulators, and amplifiers. Moreover, the course introduces other semiconductor devices like varactor diodes, LEDs, FETs, UJTs, and ICs. Finally, students gain a basic understanding of logic gates and digital circuits, including AND, OR, NAND, NOR, and XOR gates, their characteristics, implementation, and applications.

b) Pre-requisites: EEE 203

c) Co-requisite(s): Nil

d) Role in Curriculum: Core

e) Course Learning Outcome (CLO) and Programme Outcomes (PO)

Course Learning Outcomes: upon successful completion of the course, students will be able to:	**Suitable Bloom Taxonomy Relevant to the CLOs**	**POs**	**Assessment Tools**
Understand the theory, characteristics, and applications of vacuum devices such as diodes, triodes, tetrodes, and pentodes.	2, 3	1	Assignments, quizzes and Exams
Describe rectification and smoothing circuits using diodes.	1, 2	1, 3	Assignments, quizzes and Exams
Explain the principles and characteristics of semiconductor devices like p-n junction diodes, Zener diodes, and bipolar transistors.	2, 3	1	Assignments, quizzes and Exams
Identify and apply various semiconductor devices in practical applications such as rectifiers, regulators, and amplifiers.	1, 2	1, 3	Assignments, quizzes and Exams
Comprehend the basic concepts of logic gates and digital circuits, including their characteristics, implementation, and applications.	1, 3	1	Assignments, quizzes and Exams

f) Mapping of CLOs to relevant POs

Course Learning Outcomes	Programme Outcomes (POs):											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Understand the theory, characteristics, and applications of vacuum devices such as diodes, triodes, tetrodes, and pentodes.	**3**											
Describe rectification and smoothing circuits using diodes.	**3**		**3**									
Explain the principles and characteristics of semiconductor devices like p-n junction diodes, Zener diodes, and bipolar transistors.	**3**											
Identify and apply various semiconductor devices in practical applications such as rectifiers, regulators, and amplifiers.	**3**		**3**									
Comprehend the basic concepts of logic gates and digital circuits, including their characteristics, implementation, and applications.	**3**											

Keys: 1 = Slightly related, 2 = Moderately related, 3= Highly related

g) Expectations of Students

a. Attend 2 hours of lectures per week

b. Turn in assignments and projects as considered suitable by the tutors

c. Complete continuous assessment which involves mid-semester test

d. Complete a 2-hour comprehensive final examination at the end of the semester.

h) Methods of Lecture Delivery/Teaching Aids

Lecture Delivery Methods

Educator-Student Interaction (Discussion method)

Teaching Aids

Visual Aids (Use of PowerPoint slides, Lecture templates-handouts)

i) Course Content or Outline

Topics	Weeks
A. Review and Introduction to Active Devices and Diodes Recap of basic electrical concepts: voltage, current, resistance, power, and Ohm's Law. Introduction to active devices: transistors, diodes, and integrated circuits. Comparison of active and passive devices. Introduction to network synthesis: designing networks with desired characteristics. Synthesis of one-port networks using LC and RC elements. Poles, zeros, and their relationship to the frequency response of networks.	1-2
Bipolar Junction Transistors (BJTs) and BTF Amplifier • Detailed analysis of BJT structure and operation modes (active, cut-off, saturation). • BJT biasing techniques: fixed bias, emitter bias, and collector bias. • DC analysis of BJT circuits: operating point, load line, and biasing calculations. • Introduction to BJT amplifiers: basic amplifier configurations (common-base, common-emitter, common-collector). • Voltage gain, current gain, and input/output impedance of BJT amplifiers. • Frequency response of BJT amplifiers and analysis of high-frequency behavior.	3-4
Advanced Transistors Application and Other Semiconductors • Differential amplifiers using BJTs and their applications. • Multi-stage amplifiers: cascading BJT stages for higher gain. • Feedback circuits in amplifiers: negative feedback and its effects on performance. • Detailed discussion of Zener diode characteristics and its applications as a voltage regulator. • Varactor diodes and their use in tuning circuits. • Light Emitting Diodes (LEDs) and their operating principles. • Introduction to Field Effect Transistors (FETs): types and basic characteristics.	5-6
• Combinational logic circuits: design and analysis of complex logic functions. • Karnaugh maps and Boolean algebra simplification techniques.	7-9

• Multi-input, multi-output combinational logic circuits. • Introduction to sequential logic circuits: flip-flops, latches, and registers. • Types of flip-flops: SR, JK, D, and T flip-flops and their characteristics. • Analysis of sequential logic circuits and their behavior. • Counters and shift registers: design and applications in digital systems. • Memory circuits: RAM, ROM, and their basic principles. • Introduction to programmable logic devices (PLDs) and their applications.	
Introduction to Operational Amplifiers (Op-Amps) and Power Electronic • Basic principles of Op-Amps: differential gain, common-mode rejection ratio, and input/output impedance. • Inverting and non-inverting Op-Amp configurations. • Applications of Op-Amps: voltage followers, comparators, and integrators. • Introduction to power Electronic and its applications. • Basic power semiconductor devices: thyristors, TRIACs, and MOSFETs. • Single-phase and three-phase power control circuits.	10-11
Introduction to Microcontrollers • Overview of microcontrollers and their architecture. • Programming microcontrollers using assembly language or C. • Interfacing microcontrollers with external devices (sensors, actuators). • Review of key concepts covered throughout the course. • Practice problems and exercises to reinforce understanding. • Final assessment: exam or project to evaluate student learning.	12
Revision & Examination	13

j) Method of Grading Continuous Assessment

Continuous Assessment (Assignments): 15%

Continuous Assessment (Test) 15%

End of Semester Examination

k) Tutorials

Tutorials are taken at the end of each module.

l) Term Paper and Assignments

Students will complete a comprehensive term paper that covers a specific area of basic engineering, applying their knowledge and analytical skills to research, analyze, and present findings on a chosen topic. Additionally, regular assignments will be given throughout the course, covering various engineering concepts and problem-solving techniques. These assignments will reinforce the theoretical knowledge gained in lectures and provide opportunities for practical application and independent learning.

m) Contemporary Issues and Industrial Relevance

The course emphasizes the importance of understanding contemporary engineering challenges and their impact on various industries. Students will explore how basic engineering principles are applied in real-world scenarios, addressing issues such as energy efficiency, sustainable development, and technological advancements. They will gain insights into the evolving industrial landscape and how their engineering knowledge can contribute to innovative solutions for current and future challenges.

BOWEN UNIVERSITY, IWO
Faculty of Engineering
Department of Electrical/Electronic Engineering

Course Code: EEE 206
Course Title: Electrical Engineering Materials
Semester: Second
Credit Hours: 2 hours
Contact Hours: Lecture - Two hours lectures per Week
Location: Alma Rohm
Lecturer(s): Dr Osaloni O. O.
Textbooks and other Materials:

1. *Electrical Engineering Materials* by S.K. Bhattacharya, D. P. Khandelwal
2. *Introduction to Electrical Engineering Materials* by Adriana Morales-Acevedo
3. *Electronic and Electrical Engineering Materials and Devices* by Charles Kittel

a) Course Overview and description

This course delves into the fascinating world of materials science and engineering, exploring the fundamental properties of materials and how their atomic structure and bonding dictate their behavior. We'll explore how these properties translate into various functionalities crucial for technological advancements.

b) Pre-requisites: Nil

c) Co-requisite(s): Nil

d) Role in Curriculum: Core

e) Course Learning Outcome (CLO) and Programme Outcomes (PO)

Course Learning Outcomes: upon successful completion of the course, students will be able to:	**Suitable Bloom Taxonomy Relevant to the CLOs**	**POs**	**Assessment Tools**
Define the fundamental principles of atomic structure, including electron configurations and orbitals	1	1, 2	Homework, quizzes and Exams
Define and differentiate between electrical conductivity and resistivity properties of materials.	1	1, 2	Homework, quizzes and Exams
Discuss how band structures influence conductivity in metals, insulators, and semiconductors	1, 2	1, 4	Homework, quizzes and Exams
Describe the concept of semiconductor device fabrication techniques.	1, 2	1, 4	Homework, quizzes and Exams
Explain the basic characteristics and properties of transducers	2, 3	1, 3	Homework, quizzes and Exams

f) Mapping of CLOs to relevant POs

Course Learning Outcomes	Programme Outcomes (POs):											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Define the fundamental principles of atomic structure, including electron configurations and orbitals	**3**	**2**	**2**									
Define and differentiate between electrical conductivity and resistivity properties of materials.	**3**	**3**										
Discuss how band structures influence conductivity in metals, insulators, and semiconductors	**3**	**2**										
Describe the concept of semiconductor device fabrication techniques.	**2**	**3**										
Explain the basic characteristics and properties of transducers	**3**	**3**										

Keys: 1 = Slightly related, 2 = Moderately related, 3= Highly related

g) Expectations of Students

a. Attend 2 hours of lectures per week
b. Turn in assignments and projects as considered suitable by the tutors
c. Complete continuous assessment which involves mid-semester test
d. Complete a 2-hour comprehensive final examination at the end of the semester.

h) Methods of Lecture Delivery/Teaching Aids

Lecture Delivery Methods

Educator-Student Interaction (Discussion method) Video Tutorials Electrical systems

Teaching Aids

Visual Aids (Use of PowerPoint slides, Lecture templates-handouts)

i) Course Content or Outline

Topics	Weeks
Introduction and Atomic Structure • Introduction to Materials Science • Atomic Structure Review (protons, neutrons, electrons, atomic number, mass number) • Periodic Table and Periodic Trends • Electron Configurations and Lewis Structures • Analyze periodic trends and their connection to material properties (e.g., atomic radius, electronegativity) • Build models of different atom types • Practice writing electron configurations and Lewis structures	1-2
Chemical Bonding in Solids • Ionic Bonding: formation, characteristics, examples (salts) • Covalent Bonding: types (polar, non-polar), examples (diamond, water) • Metallic Bonding: delocalized electrons, properties of metals • Analyze electrostatic attractions in ionic bonding • Build models of ionic and covalent solids • Discuss the relationship between bond type and physical properties (melting point, hardness)	3-4
Electrons in Solids and Electrical Properties • Band Theory: conductors, insulators, semiconductors. • Doping of Semiconductors: n-type, p-type, applications (transistors) • Electrical Conductivity and Resistivity	5-6
Dielectric Properties and Applications • Permittivity: storing electrical energy, dielectric constant • Polarization: displacement of charges in an electric field • Frequency Response: dependence of dielectric properties on frequency • Applications of Dielectric Materials (capacitors, insulators) • Analyze the relationship between permittivity and capacitance. • Research and present on different dielectric materials and their uses. • Design a simple capacitor using available materials.	7-8
Magnetic Properties of Materials • Magnetic Moments: origin in atomic orbitals, paramagnetism, diamagnetism • Permeability: quantifying magnetic field strength • Hysteresis: behavior of magnetic materials under changing fields • Applications of Magnetic Materials (permanent magnets, transformers)	9-10

• Conduct experiments demonstrating different types of magnetism (iron filings, diamagnetic levitation) • Analyze hysteresis loops and their significance in magnetic materials • Research and present on applications of magnetic materials in technology	
Thermal and Optical Properties of Materials • Thermal Conductivity: heat transfer through a material • Specific Heat Capacity: ability to store thermal energy • Thermal Expansion: response of materials to temperature changes • Optical Properties: reflection, refraction, absorption, transmission • Design and conduct experiments to measure thermal conductivity of different materials • Analyze the relationship between specific heat capacity and material applications • Discuss the role of optical properties in various materials (e.g., solar cells, windows)	11-12
Lecture free week	13
Revision & Examination	14-15

j) Method of Grading Continuous Assessment

Continuous Assessment (Assignment):10 %
Continuous Assessment Test 2 (Mid-semester test): 20%
End of Semester Examination :70%

k) Tutorials

Tutorials are taken at the end of every module.

l) Term Paper and Assignments

mid-semester will be conducted.

m) Contemporary Issues and Industrial Relevance

Electrical engineering materials play a crucial role in developing and optimizing modern technologies. Here's an exploration of some key areas where contemporary issues and industrial relevance intersect:

Materials for Sustainable Energy Technologies:

- **Contemporary Issues:**
    - Developing high-efficiency materials for solar cells and energy storage devices (batteries and supercapacitors).
    - Exploring sustainable and environmentally friendly materials for energy generation and storage.
    - Designing materials with improved thermal management properties for high-power applications.
- **Industrial Relevance:**
    - Transitioning towards renewable energy sources like solar and wind power.

- Development of electric vehicles and energy-efficient Electronic.
- Building a sustainable energy infrastructure with minimal environmental impact.

BOWEN UNIVERSITY, IWO
Faculty of Engineering
Department of Electrical/Electronic Engineering

Course Code: MCT 208 **Course Title:** Engineer in Society
Semester: Second **Credit Hours**: 1 hours
Contact Hours: Lecture - One-hour lectures per Week
Location: Alma Rohm **Lecturer(s)**: Dr. Osaloni. O. O.
Textbooks and other Materials:

- Engineering and Society: Impact of Engineering on Civilization by *Geoffrey Hewlett* (2015)
- Engineering in Context: Addressing Global Needs by *John R. Canada* (2022)

a) Course Overview and description

This course explores the philosophical foundations of science and engineering, the history of technological advancements, and the ethical and professional responsibilities of engineers in society, with a specific focus on Nigeria's development needs.

b) Pre-requisites: Nil

c) Co-requisite(s): Nil

d) Role in Curriculum: Core

e) Course Learning Outcome (CLO) and Programme Outcomes (PO)

f) Mapping of CLOs to relevant POs

Course Learning Outcomes: upon successful completion of the course, students should be able to:	**Suitable Bloom Taxonomy Relevant to the CLOs**	**POs**	**Assessment Tools**
Explain the basic principles of the philosophy of science and its relationship to engineering.	1,2	2	Assignment, Quizzes & Exam

Describe the various engineering disciplines and their roles in national development	2,3	2,6,7	Assignment, Quizzes & Exam
Identify the key skills and ethical considerations required of professional engineers.	1,2	4,8	Assignment, Quizzes & Exam
Apply basic principles of risk analysis to engineering projects.	2,3	3,5	Assignment, Quizzes & Exam
Understand the importance of safety in engineering design and practice.	2,3	3,5	Assignment, Quizzes & Exam
Analyse the role of engineers in achieving national development goals (focusing on Nigeria).	2,3	6,7,8	Assignment, Quizzes & Exam

Mapping of CLOs to POs

	Program Outcomes (POs)											
Course Learning Outcomes (CLOs)	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Explain the basic principles of the philosophy of science and its relationship to engineering.		3										
Describe the various engineering disciplines and their roles in national development		2				3	3					
Identify the key skills and ethical considerations required of professional engineers.			3					3				
Apply basic principles of risk analysis to engineering projects.			2		3							
Understand the importance of safety in engineering design and practice.			3		2							
Analyse the role of engineers in achieving national development goals (focusing on Nigeria).						2	2	2				

Keys: 1 = Slightly related, 2 = Moderately related, 3= Highly related

g) Expectations of Students

a. Attend 1 hour of lectures per week

b. Turn in assignments and projects as considered suitable by the tutors

c. Complete continuous assessment which involves mid-semester test

d. Complete a 1-hour comprehensive final examination at the end of the semester.

h) Methods of Lecture Delivery/Teaching Aids

Lecture Delivery Methods

Educator-Student Interaction (Discussion method) Video Tutorials Electrical systems

Teaching Aids

Visual Aids (Use of PowerPoint slides, Lecture templates-handouts)

i) Course Content or Outline

Topics	Weeks
Foundational Concepts • **Introduction to Philosophy of Science** • How scientific knowledge is acquired and validated • Impact of science on engineering • **History of Engineering and Technology** • Major turning points in engineering history • How engineering has shaped society	1-2
Core Engineering Principles • **Introduction to Engineering** • Different engineering disciplines and their applications • Who is an engineer? Roles and responsibilities • **Engineering Skills and Development** • Basic math, science, and problem-solving skills for engineers • Communication, teamwork, and critical thinking skills • Career paths in engineering • **Safety in Engineering & Introduction to Risk Analysis** • Importance of safety principles in engineering design and practice • Identifying and mitigating engineering risks	3-5
Engineering for Nation Building • **The Role of Engineers in Nation Building** • Case study: The engineer's role in the Nigerian local content initiative • How engineering contributes to infrastructure development, economic growth, and social progress • **Development of Different Branches of Engineering** • Civil, mechanical, electrical, chemical, and other major engineering disciplines • Specific applications of each discipline relevant to Nigeria's development needs • **Engineering Ethics and Conducts** • Professional ethics and codes of conduct for engineers • Sustainability and ethical considerations in engineering design	6-8
Engineering Practice and Professionalism • The Engineer's Role in Vision 2030 (Nigeria's development plan) • How engineering will help to achieve the goals of Vision 2030 • Specific engineering projects aligned with the national vision • **Public Interest and the Professional Engineer** • Balancing public good with private interests in engineering projects • The engineer's responsibility to society • **The Engineer's Code of Practice** • Professional engineering codes and standards in Nigeria	9-12

• Applying ethical principles to real-world engineering scenario • **Design Specifications and Standards** • Importance of design specifications and following engineering standards • Case studies of projects following or deviating from standards • **Guest Lectures and Industry Exposure**	
Lecture free week	13
Revision & Examination	14 - 15

j) Method of Grading Continuous Assessment

Continuous Assessment (Assignment): 10%
Continuous Assessment Test 2 (Term Paper): 20%
End of Semester Examination: 70%

k) Tutorials

Tutorial will be offered at the end of each module.

l) Term Paper and Assignments

This term paper challenges you to delve into the fascinating world of Engineering, that Engineers are not merely technical problem solvers; they are vital contributors to societal progress and well-being. Emphasize the evolving role of engineers in addressing complex challenges and shaping a sustainable future.

m) Contemporary Issues and Industrial Relevance

The role of engineers in society is constantly evolving, adapting to meet new challenges and opportunities. Here's a breakdown of some key areas where contemporary issues and industrial relevance intersect for engineers:

1. **Emerging Technologies and Ethical Dilemmas**
2. **Sustainability and Resource Management**
3. **Globalization and Societal Needs**

Industrial Relevance:

These contemporary issues translate into concrete demands for engineers in various industries:

- **Energy Sector:** Developing renewable energy sources, designing energy-efficient grids, and improving energy storage technologies.
- **Manufacturing Sector:** Automating processes with robots, optimizing production for efficiency, and integrating AI for intelligent manufacturing.
- **Construction Sector:** Designing sustainable buildings, incorporating smart technologies for building management, and developing disaster-resistant infrastructure.
- **Healthcare Industry:** Creating medical devices, designing telemedicine solutions, and utilizing AI for diagnostics and personalized medicine.

BOWEN UNIVERSITY, IWO
Faculty of Engineering
Department of Electrical/Electronic Engineering

Course Number: MCT 204 **Course Title:** Fundamentals of Thermodynamics
Semester: Second **Credit Hours**: 2 hours
Contact Hours: Lecture- Two hours lecture (once per week)
Location: Alma Rohm **Lecturer(s)**: Dr. S.A. Ajayi

Textbooks and other materials

1. Moran, Michael J., Shapiro, Howard N., Munson, Bruce R. and DeWitt, David P. (2003), Introduction to Thermal Systems Engineering: Thermodynamics, Fluid Mechanics, and Heat Transfer, John Wiley & Sons, Inc., USA.
2. Cengel, Y. A. and Boles, M. A. (2006). Thermodynamics: An Engineering Approach, 5th Edition, McGraw Hill.
3. U. S. DOE (1992), Thermodynamics, Heat Transfer, and Fluid Flow-Department of Energy Fundamentals Handbook, Washington, D.C.
4. Rajput, R. K. (2006). Thermal Engineering, Laxmi Publications (P) Ltd., New Delhi.
5. Roger, G. F. C. and Mayhew, Y. R. (1992). Engineering Thermodynamics: Work and Heat Transfer, Longman Group Limited, 4th Edition, UK.

a) Course Overview and description

Basic concepts, definitions, and laws (quantitative relations of Zeroth, first, second and third laws of thermodynamics). Properties of pure substances: the two-property rule (P-V-T behaviour of pure substances and perfect gases); state diagrams. The principle of corresponding state; compressibility relations; reduced pressure; reduced volume; temperature; pseudo-critical constants. The ideal gas: specific heat, polytropic processes. Ideal gas cycles; Carnot; thermodynamic cycles, turbines, steam and gas, refrigeration. The first law of thermodynamics – heat and work, applications to open and closed systems. The steady flow energy equation (Bernoulli's equation) and application. Second law of thermodynamics, heat cycles and efficiency.

b) Pre-requisites: Physics and Mathematics

c) Co-requisite: Nil

d) Role in curriculum: Required (Engineering topics)

e) Course Learning Outcome (CLO) and Programme Outcomes (PO)

Course Learning Outcomes: upon successful completion of the course, students should be able to:	Suitable Bloom Taxonomy Relevant to the CLOs	POs	Assessment Tools
1. Apply the first law of thermodynamics to analyze energy transfer processes, including heat transfer and work interactions, in various engineering systems.	1,2,3	3,5,9	Assignment, Quizzes & Exam
2. Apply the zeroth law of thermodynamics to understand thermal equilibrium and temperature measurement.	1,2,3	3,5,9	Assignment, Quizzes & Exam
3. Apply thermodynamics principles to real-world engineering problems involving power plants, heat engines, and thermal devices.	2,3	5,9	Assignment, Quizzes & Exam
4. Demonstrate effective communication of thermodynamic concepts and solutions through written reports, oral presentations, and graphical representations.	2,3	3,5,10	Assignment, Quizzes & Exam
5. Perform thermodynamic cycle analysis for power generation and refrigeration cycles (e.g., Carnot cycle, Rankine cycle, vapor compression cycle).	2,3	2,4,9	Assignment, Quizzes & Exam

f) Mapping of CLO to POs

	Program Outcomes (POs)											
Course Learning Outcomes (CLOs)	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Apply the first law of thermodynamics to analyze energy transfer processes,			2		3				3			

including heat transfer and work interactions, in various engineering systems.												
Apply the zeroth law of thermodynamics to understand thermal equilibrium and temperature measurement.			2		3				3			
Apply thermodynamics principles to real-world engineering problems involving power plants, heat engines, and thermal devices.					3				3			
Demonstrate effective communication of thermodynamic concepts and solutions through written reports, oral presentations, and graphical representations.			2		3					3		
Perform thermodynamic cycle analysis for power generation and refrigeration cycles (e.g., Carnot cycle, Rankine cycle, vapor compression cycle).		3			2				3			

g) Expectations of Students

a. Attend three (2) hours of lectures per week
b. Turn in problem set assignments and term papers as deemed fit by the instructors
c. Complete continuous assessment which comprises lab practical and tests
d. Complete a three (2) hour comprehensive final examination at the end of the semester.

h) Methods of Lecture Delivery/Teaching Aids

Lecture Delivery Methods
Lecturing/Teaching Method
Educator-Student Interaction (Discussion method)
Tutorial Method
Teaching Aids
Visual Aids (Use of PowerPoint slides, Lecture templates-handouts)

i) Course Content or Outline

Topics	Weeks
Describe basic concepts of thermodynamics, quantitative relations of Zeroth, first, second and third laws	1
Define and explain system, surrounding, closed and open system, control volume and control mass, extensive and intensive properties	2
Calculate absolute and gauge pressure, and absolute temperature, calculate changes in kinetic, potential, enthalpy and internal energy;	3

Evaluate the properties of pure substances i.e. evaluate the state of the pure substances such as compressed liquid, saturated liquid-vapour mixture and superheated vapour using property diagrams and tables; arrange the ideal and real gas equations of state,	4
Formulate the first law of thermodynamics for a closed system i.e. organize the change in energy in the closed systems via heat and work transfer;	5
Tutorial	6
Distinguish heat transfer by conduction, convection, and radiation, and calculate the amount of heat energy transferred;	7
Calculate the changes in moving boundary work, spring work, electrical work, and shaft work in closed systems;	8
Apply the first law of thermodynamics for closed systems and construct conservation of mass and energy equations;	9
Formulate the first law of thermodynamics to the open systems i.e. describe steady-flow open system, apply the first law of thermodynamics to the nozzles, diffusers, turbines, compressors, throttling valves, mixing chambers, heat exchangers, pipe and duct flow;	10
Construct energy and mass balance for unsteady-flow processes	11
Evaluate thermodynamic applications using second law of thermodynamics	12
Calculate thermal efficiency and coefficient of performance for heat engine, refrigerators and heat pumps;	13
Lecture free week	13
Revision & Examination	14 - 15

j) Tutorials

Tutorials are taken at the end of each module.

k) Method of Grading Continuous Assessment

Continuous Assessment Test 1: **15%**
Continuous Assessment Test 2 (Mid-Semester Examination): **15%**
End of Semester Examination : **70%**

l) Term Paper and Assignments

Assignments/Students Activities will be 60% dependent on the discovery made, questions arising from class discussion and during lectures.

m) Contemporary Issues and Industrial Relevance

Very relevant in facilitating efficient engineering design and analysis of energy systems and providing a basis for further study and research in energy conversion systems.

BOWEN UNIVERSITY, IWO
Faculty of Engineering
Department of Electrical/Electronic Engineering

Course Code: EEE 200 **Course** Students Work Experience Programme
Semester: Second **Credit Hours**: 2 hours
Contact Hours: Lecture - 30 hours lectures per Week
Location: Engineering Workshop **Lecturer(s)**: All Staff
Textbooks and other Materials:

1. *Entrepreneurship for Engineers* by Mark J. DeLong (2020)

The Industrial Training Fund (ITF) publishes guidelines and information booklets on SIWES which can be found on their website https://www.siwes.itf.gov.ng/Identity/LandingPage/siwes.

a) Course Overview and description

The course is structured in such a way to foster in-depth understanding of Electrical services and its relation to industries. Issues of Safety and Regulations of Electrical installations were given an in-depth consideration.

b) Pre-requisites: Nil

c) Co-requisite(s): Nil

d) Role in Curriculum: Core

e) Course Learning Outcome (CLO) and Programme Outcomes (PO)

Course Learning Outcomes: upon successful completion of the course, students will be able to:	**Suitable Bloom Taxonomy Relevant to the CLOs**	**POs**	**Assessment Tools**
Define industrial workplace perceptions, ethics, health and safety consciousness, interpersonal skills and technical capabilities needed to give them a sound engineering foundation	1	1, 2, 12	Practical and Oral Exams
Understand basic engineering techniques and processes applicable to engineering specializations	1, 2	1, 2, 8	Practical and Oral Exams
Identify machines, devices, structures, or facilities relevant to their specific engineering programmes and applications	1, 3	1, 3, 4, 11	Practical and Oral Exams
Demonstrate competence in technical documentation (log-book) and presentation (report) of their practical experiences.	2, 3	1, 10, 12	Practical and Oral Exams

f) Mapping of CLOs to relevant POs

Course Learning Outcomes	Programme Outcomes (POs):											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Define industrial workplace perceptions, ethics, health and safety consciousness, interpersonal skills and technical capabilities needed to give them a sound engineering foundation	**3**	**3**										**3**
Understand basic engineering techniques and processes applicable to engineering specializations	**3**	**3**						**3**				
Identify machines, devices, structures, or facilities relevant to their specific engineering programmes and applications	**3**		**3**	**3**							**3**	
Demonstrate competence in technical documentation (log-book) and presentation (report) of their practical experiences.	**3**									**2**		**2**

Keys: 1 = Slightly related, 2 = Moderately related, 3= Highly related

g) Expectations of Students

a. Attend 30 hours of Workshop practice per week

b. Turn in assignments and projects as considered suitable by the tutors

c. Complete continuous assessment which involves mid-semester test

d. Complete a 2-hour comprehensive final examination at the end of the programme.

h) Methods of Lecture Delivery/Teaching Aids

Lecture Delivery Methods

Workshop /Laboratory

i) Course Content or Outline

Topics	Weeks
Opening of SWEP Programme by the Provost of the Faculty • Introduction to laboratory rules and regulations. • Tour on school facilities around the campus. • Tour on school facilities around the campus continues	1
• Design and construction of solar charge controller and battery power bank	1-2
• Design and construction of electrical house wiring board	2-3
• Design and construction of mini solar inverter	3-4
• Design and construction of day/night detector circuit and solar streetlight	4-5
• Design and construction of grass lawn mower	5-6
• Solar power design and installation	6-7
• Students work presentation and defense	7-8

j) Method of Grading Continuous Assessment

Students work presentation and defense

k) Tutorials

Workshop/laboratory practice

l) Term Paper and Assignments

Assignments

m) Contemporary Issues and Industrial Relevance

Contemporary Issues:

- Generic Placements: SWEPs might struggle to secure placements that offer students experience specific to their field of study. This can lead to generic work tasks that don't contribute much to their professional development.
- Short-term Focus: SWEPs are often short-term programs, making it difficult for students to get deeply involved in complex projects or develop a strong understanding of industry processes.
- Lack of Mentorship: Without proper mentorship during the program, students may miss out on valuable guidance and opportunities to learn from experienced professionals.
- Unpaid Work: If SWEPs are unpaid, it can create challenges for students from disadvantaged backgrounds who may struggle to afford living expenses during the program.

Maintaining Industrial Relevance:

- Focus on Skills, not Tasks: Shifting the focus from completing specific tasks to developing relevant skills can make the program more adaptable to different work environments.
- Micro-internships: Exploring shorter, project-based placements can offer students exposure to specific industry challenges and problem-solving opportunities.
- Virtual Work Opportunities: Integrating virtual work experiences allows students to gain exposure to remote work settings, a growing trend in many industries.
- Soft Skills Development: SWEPs should prioritize the development of soft skills like communication, teamwork, and critical thinking, which are valuable across all industries.

Bridging the Gap:

- Industry Collaboration: Partnerships between universities and companies can help design SWEPs that offer targeted learning experiences aligned with industry needs.
- Skill-based Matching: Matching students' skills and interests with appropriate work placements can lead to more focused and relevant experiences.
- Online Learning Integration: Combining work experience with online learning modules can provide students with a deeper understanding of the theoretical underpinnings of their practical work.
- Feedback and Reflection: Encouraging regular feedback from supervisors and providing opportunities for reflection can help students solidify their learning and identify areas for further development.

BOWEN UNIVERSITY, IWO
Faculty of Engineering
Department of Mechatronics Engineering

Course Number: MCT 201 **Course Title: Engineering Drawing 1**
Semester: First **Credit Hours**: 2 hours
Contact Hours: Lecture - Two hours lectures per Week
Location: Drawing Studio **Lecturer(s)**: Engr. Prof. Adekunle, Engr. Kehinde

Textbooks and other Materials:

1. Engineering Drawing by N.D. Bhatt
2. J N Green Metric edition
3. M A Parker and F Pickup 3rd edition
4. A Textbook of Engineering Drawing by RK Dhawan
5. Fundamentals of Engineering Drawing: A to Z of Principles of Orthographic Projection, Projections of Points & Projections of Lines by Er Alok Kumar Jha

Course Description:
This course introduces you to the fundamental principles and practices of engineering drawing, the cornerstone of communication in the engineering world. Through a combination of theoretical concepts, practical exercises, and potentially both manual drafting techniques and Computer-Aided Design (CAD) software, you will gain a comprehensive understanding of how to visually represent and communicate engineering ideas.

Course Learning Outcome (CLO) and Programme Outcomes (PO)

Course Learning Outcomes: upon successful completion of the course, students should be able to:	**Suitable Bloom Taxonomy Relevant to the CLOs**	**POs**	**Assessment Tools**
Understand the purpose and importance of engineering drawings.	2,3	1,2	Classwork & Quizzes
Demonstrate proficiency bisecting lines and constructing angles, triangles, polygons.	3,5	1,2,5	Classwork & Exams
Apply geometric principles to drawing creation.	3,5	2,3,5	Classwork & Assignments

Draw an ellipse, locus, cycloid, involute, epicycloid, hypocycloid, and helixes.	3,5	3,5	Classwork, Quizzes and Assignments

Mapping of CLOs to POs

Course Learning Outcomes (CLOs)	Program Outcomes (POs)											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Understand the purpose and importance of engineering drawings.	2	3										
Demonstrate proficiency bisecting lines and constructing angles, triangles, polygons.	2	1			3							
Apply geometric principles to drawing creation.		2	3		3							
Draw an ellipse, locus, cycloid, involute, epicycloid, hypocycloid and helixes.			3		3							

Keys: 1 = Slightly related, 2 = Moderately related, 3= Highly related

Module Structure (Weekly Breakdown):

S/N	ACTIVITIES	WEEKS
1	**Introduction to Engineering Drawing** • Introduction to the field of engineering drawing and its applications. • Understanding different drawing types (assembly, detail, etc.). • Drawing tools and equipment (traditional and digital). • Introduction to geometric drawing principles (lines, angles, shapes). • Importance of line types, conventions, and symbols in drawings.	1-2
2	**Orthographic Projections** • Introduction to orthographic projection (multi-view drawings). • Creating basic orthographic views (front, top, side) of simple objects. • Understanding hidden lines and their representation. • Dimensioning basics: types of dimensions (linear, angular, etc.). • Introduction to tolerances and specifications.	3-5
3	**Advanced Projections and Sections** • Auxiliary views: creating additional views for clarity.	6-8

	• Isometric and other pictorial projections: visualizing 3D objects. • Sectional views: representing internal features of objects. • Different types of sections (full, half, sectional breaks). • Assembly drawings: combining detailed parts into a complete assembly.	
4	**Dimensioning and Tolerances** • Advanced dimensioning techniques: dimensioning for different features (holes, arcs, etc.). • Dimensioning practices according to standards (ANSI, ISO, etc.). • Geometric dimensioning and tolerancing (GD&T) introduction. • Understanding tolerances and their impact on manufacturing	9-11
5	**Introduction to CAD (Optional)** • Introduction to basic functionalities of CAD software (if applicable). • Creating basic 2D drawings using CAD tools. • Dimensioning and annotation in CAD environment. • Benefits and limitations of using CAD for engineering drawings.	12-13
6	**Revision and Examinations**	13-15

Assessment:

- Weekly assignments (drawing exercises, quizzes).
- Mid-term exam (covering weeks 1-7).
- Final project (creating a complete engineering drawing of a specified object).

Teaching Methods:

- A combination of lectures, demonstrations, hands-on activities, and discussions.
- Use of visual aids such as drawings, models, and CAD software (if applicable).
- Encouragement of student participation through questions, discussions, and project work.

j) Method of Grading Continuous Assessment

Continuous Assessment Test 1: 10%

Continuous Assessment Test 2 (Test): 20%

End of Semester Examination : 70%

k) Tutorials

- End of Week 2: Tutorial 1 (Moodle 1 & Moodle 2)
- End of Week 9: Tutorial 2 (Moodle 3 to Moodle 5)
- End of Week 12: Tutorial 3 (Moodle 6)
- Week 12: End of Semester Tutorials

m) Contemporary Issues and Industrial Relevance

Contemporary Issues and Industrial Relevance of Engineering Drawing

Engineering drawing, despite the rise of 3D modeling with Computer-Aided Design (CAD) software, remains an important skill and holds significant relevance in contemporary industry.

Contemporary Issues:

- **Shift to CAD:** While traditional manual drawings are less common, interpreting and understanding 2D drawings from 3D models can be a challenge for some new engineers.
- **Focus on 3D Modeling:** Educational emphasis on 3D modeling software might lead to a skills gap in understanding the underlying principles of engineering drawing and its role in communication.

Industrial Relevance:

- **Universal Language:** Engineering drawings act as a universal language, enabling clear communication across design, manufacturing, and assembly stages, even if performed in different locations.
- **Standardization and Precision:** Drawings enforce standardization and ensure precise dimensional accuracy for parts and assemblies, crucial for proper function.
- **Documentation and Archiving:** Drawings serve as legal documents and a permanent archive of a product's design intent, vital for maintenance, troubleshooting, and future modifications.
- **Understanding Underlying Concepts:** An understanding of engineering drawing principles strengthens a core foundation for visualizing and interpreting 3D models effectively.
- **Complementary to 3D Modeling:** Drawings can be used alongside 3D models for tasks like detailing specific dimensions, tolerances, and annotations that might be difficult to convey clearly in a 3D model.

BOWEN UNIVERSITY, IWO
Faculty of Engineering
Department of Mechatronics Engineering

Course Number: MCT 202 **Course Title:** Engineering Drawing II
Semester: First **Credit Hours**: 2 hours
Contact Hours: Lecture – 2 hours lectures per Week
Location: Alma Rohm **Instructor(s)**: Engr. Dosumu

Textbooks and other Materials:
1. **Engineering Drawing by N.D. Bhatt**
2. A Textbook of Engineering Drawing by RK Dhawan
3. Fundamentals of Engineering Drawing: A to Z of Principles of Orthographic Projection, Projections of Points & Projections of Lines by Er Alok Kumar Jha

Course Description:
Building upon the foundations of Engineering Drawing 1, this course equips you with advanced skills in creating and interpreting technical drawings used across various engineering disciplines.

Course Learning Outcome (CLO) and Programme Outcomes (PO)

Course Learning Outcomes: upon successful completion of the course, students should be able to:	**Suitable Bloom Taxonomy Relevant to the CLOs**	**POs**	**Assessment Tools**
Gain experience in interpreting and communicating engineering designs through drawings	1,2	3,10	Practical, Classwork & Quizzes
Develop proficiency in using industry-standard dimensioning and tolerancing practices.	2,3	3,5	Practical, Classwork & Exams
Master isometric and oblique drawing techniques to effectively visualize objects in three dimensions.	2,3	2,3,5	Practical, Classwork & Assignments

Interpret complex engineering drawings and accurately visualize the objects they represent.	1,2	3,4	Practical, Classwork & Exams
Generate detailed drawings of individual components, providing all the necessary information for manufacturing.	2,3	3,5	Practical, Classwork & Assignments

Mapping of CLOs to POs

Course Learning Outcomes (CLOs)	Program Outcomes (POs)											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Gain experience in interpreting and communicating engineering designs through drawings			3							2		
Develop proficiency in using industry-standard dimensioning and tolerancing practices.			3		3							
Master isometric and oblique drawing techniques to effectively visualize objects in three dimensions.		2	3		3							
Interpret complex engineering drawings and accurately visualize the objects they represent.			3	2								
Generate detailed drawings of individual components, providing all the necessary information for manufacturing.			3		3							

Keys: 1 = Slightly related, 2 = Moderately related, 3= Highly related

Prerequisites:
Successful completion of Engineering Drawing 1 or a demonstrated understanding of fundamental engineering graphics principles.

Module Structure (Weekly Breakdown):

<table>
<tr><th>S/N</th><th>ACTIVITIES</th><th>WEEKS</th></tr>
<tr><td>1</td><td>Advanced Orthographic Projection
Review of basic orthographic projections (multiview drawings) from Engineering Drawing 1.
Introduction of advanced techniques:
Half sections, revolved sections, offset sections (Weeks 1-2)
Depicting threads, fasteners, and other standard features (Week 2)
Aligned views and treatment of unimportant features (Week 3)
Applying these techniques through practical exercises (isometric drawings to orthographic projections, converting assembly views to orthographic drawings).
Introduction to dimensioning basics (lines, symbols, types).</td><td>1-3</td></tr>
<tr><td>2</td><td>Sectional Views and Conventions
Different types of sections (full sections, half sections, offset sections, broken sections) and their applications (Week 4).
Hatching conventions for various materials and their proper application (Week 4).
Representing features hidden by sections and creating sectional views of assembled objects (Weeks 5-6).
Introduction to tolerancing concepts (specifying limits of variations).</td><td>4-6</td></tr>
<tr><td>3</td><td>Dimensioning and Tolerancing
Advanced dimensioning techniques for complex geometries (e.g., dimensioning holes, radii, angles).
Introduction to Geometric Dimensioning and Tolerancing (GD&T) principles (symbols, datums) (Week 7).
Applying GD&T to specify tolerances for various features (size, form, location) (Weeks 8-9).
Practice exercises involving dimensioning and tolerancing of engineering components.</td><td>7-9</td></tr>
<tr><td>4</td><td>Pictorial Drawing and Assembly Drawings
Isometric drawing techniques: creating isometric drawings from orthographic</td><td>10-11</td></tr>
</table>

	projections, dimensioning isometric drawings (Week 10). • Oblique drawing techniques (optional, can be covered briefly) (Week 10). • Introduction to assembly drawings: concept, purpose, and basic components (Week 11). • Creating assembly drawings showing how parts fit together (exploded views can be introduced).	
5	**Detail Drawings and Introduction to CAD (Optional)** • Detail drawings: purpose, level of detail, and relationship to assembly drawings (Week 12). • Introduction to Computer-Aided Design (CAD) software (optional): basic functionalities for creating and editing engineering drawings (Week 12). **Review, Projects, and Course Evaluation** • Review key concepts covered throughout the semester (Week 13). • Student presentations (optional): Students can present projects or complex drawings completed during the course (Week 13). • Course evaluation and feedback (Week 13).	12-13
6	Revision and Examinations	13-15

Assessment:

- Weekly assignments (drawing exercises, quizzes).
- Mid-term exam (covering weeks 1-7).
- Final project (creating a complete engineering drawing of a specified object).

Additional Resources:

- Textbook on engineering drawing principles.
- Online tutorials and practice exercises for engineering drawing software (if applicable).
- Engineering drawing standards manuals (ANSI, ISO, etc.).

Teaching Methods:

- A combination of lectures, demonstrations, hands-on activities, and discussions.
- Use of visual aids such as drawings, models, and CAD software (if applicable).
- Encouragement of student participation through questions, discussions, and project work.

Method of Grading Continuous Assessment

Continuous Assessment Test 1: 10%

Continuous Assessment Test 2 (Test): 20%

End of Semester Examination : 70%

Tutorials
End of Week 2: Tutorial 1 (Moodle 1 & Moodle 2)
End of Week 9: Tutorial 2 (Moodle 3 to Moodle 5)
End of Week 12: Tutorial 3 (Moodle 6)
Week 12: End of Semester Tutorials

Contemporary Issues and Industrial Relevance of Engineering Drawing

Engineering Drawing 2 plays a crucial role in the modern engineering industry, even with the rise of Computer-Aided Design (CAD) software. Here's a breakdown of contemporary issues and its continued importance:

Contemporary Issues:

- **Balance between Traditional Skills and CAD Reliance:** While CAD offers efficiency and automation, a solid foundation in manual drafting skills remains valuable. Engineering Drawing 2 can help bridge this gap by:
- Emphasizing core principles that translate well to CAD software (visualization, spatial reasoning, dimensioning concepts).
- Teaching students to interpret and critically evaluate CAD-generated drawings.
- **Evolving Manufacturing Techniques:** Additive manufacturing (3D printing) and other advanced techniques require clear and concise communication of design intent. Engineering Drawing 2 can ensure students understand:
- How to depict complex geometries and features accurately for these processes.
- The importance of tolerancing for proper functionality in 3D-printed parts.
- **Globalized Workforce and Communication:** Engineering projects often involve collaboration across borders. Engineering Drawing 2 emphasizes:
- Following universal drafting standards for clear and unambiguous communication.
- The ability to interpret drawings created by international teams.

Industrial Relevance:

- **Foundation for Advanced Engineering Practices:** Engineering Drawing 2 provides a strong foundation for:
- Understanding and interpreting complex engineering designs.
- Effectively communicating design ideas through drawings.
- Preparing detailed drawings for manufacturing and assembly.
- **Problem-Solving and Visualization Skills:** The course hones students' problem-solving abilities by:
- Requiring them to visualize 3D objects from 2D representations.
- Demanding clear and concise communication of design intent through drawings.
- **Integration with CAD Software:** Knowledge of traditional drafting principles complements CAD software. Students can:
- Leverage their understanding of drawing standards and conventions within CAD environments.
- Create more accurate and efficient drawings due to a strong grasp of underlying concepts.
- **Versatility and Adaptability:** While some drafting tasks are automated, engineers still need to:
- Sketch initial design concepts and ideas.
- Effectively mark up and revise CAD drawings.
- Understand and troubleshoot issues arising from drawings during manufacturing.

BOWEN UNIVERSITY, IWO
Faculty of Engineering
Department of Mechatronics Engineering

Course Number: MCT 203
Course Title: Fundamentals of Fluid Mechanics
Semester: First
Credit Hours: 2 hours
Contact Hours: Lecture - Two hours lectures per Week
Location: New Horizon
Lecturer(s): Dr. Onokwai, & Dr. Uguru-Okorie

Textbooks and other Materials:

i. Fluid and Thermodynamics: Volume 1: Basic Fluid Mechanics, 652 Pages · 2016 by Kolumban Hutter & Yongqi Wang (auth.)
ii. R.K. Bansal (2005), Fluid Mechanics and Hydraulic Machines (9^{th} Edition), Elsevier.
iii. J. Carvill (2005), Mechanical Engineers Data Handbook (11^{th} Edition), Elsevier.
iv. Introduction to theoretical aerodynamics and hydrodynamics 2011, 220 Pages, by Sears W.M.
v. Textbook: "Fundamentals of Fluid Mechanics" by Munson, Young, and O'Brien (or similar)
vi. Online resources like National Committee for Fluid Mechanics Films
vii. Software tools for fluid mechanics simulations (optional)

Course Description

The course looks into the key properties of fluids, including density, viscosity, surface tension, and vapor pressure. You'll explore the concepts of fluid statics, analyzing pressure distribution, buoyancy, and stability of submerged objects. Moving to fluid motion, you'll master the principles of fluid kinematics, including streamlines, continuity equation, and different flow regimes (steady, unsteady, laminar, turbulent). Understanding these concepts lays the groundwork for applying Bernoulli's equation, a cornerstone of fluid dynamics, to analyze energy transfer in fluids. The course looks deeper into internal flow, exploring pipe flow characteristics, head loss calculations, and the impact of pipe size and friction. You'll gain insight into boundary layer theory, a crucial concept for understanding drag forces in fluids.

1. **Pre-requisites:** Physics, chemistry and Mathematics
2. **Co-requisite(s):** none
3. **Role in Curriculum:** Required (Engineering Topics)

Course Learning Outcome (CLO) and Programme Outcomes (PO)

Course Learning Outcomes: upon successful completion of the course, students should be able to:	**Suitable Bloom Taxonomy Relevant to the CLOs**	**POs**	**Assessment Tools**
Understand the basic properties of fluids.	2,3	1,2	Classwork & Quizzes
Analyze fluid flow concepts like continuity and Bernoulli's equation.	3,4,5	1,2,3,5	Classwork & Exams
Solve problems involving ideal and real fluids.	3,5	2,3,5	Classwork & Assignments
Understand fluid machinery principles	2,3,5	3,5	Classwork, Quizzes and Assignments

Mapping of CLOs to POs

Course Learning Outcomes (CLOs)	**Program Outcomes (POs)**											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Understand the basic properties of fluids.	3	2										
Analyze fluid flow concepts like continuity and Bernoulli's equation.	1	3	2		2							
Solve problems involving ideal and real fluids.		2	3		2							
Understand fluid machinery principles			3		2							

Keys: 1 = Slightly related, 2 = Moderately related, 3= Highly related

Course Status

Compulsory course

Expectations of students

This course requires a commitment to active learning and a strong foundation in mathematics. To ensure a successful learning experience, here are the expectations for students:

- Regular attendance: Actively participate in lectures, discussions, and in-class activities.
- Come prepared: Review assigned readings and complete any pre-class activities before each lecture.
- Complete all assigned readings: Textbooks, articles, or online resources as specified by the instructor.

- Take comprehensive notes: Pay close attention during lectures and actively participate in discussions.
- Practice problem-solving: Regularly work on assigned problems and practice exercises to solidify your understanding.
- Seek clarification: Don't hesitate to ask questions during lectures, office hours, or via email if you need clarification on any concepts.
- Complete all quizzes and exams: Demonstrate your understanding of the course material through scheduled assessments.
- Actively participate in class discussions: Contribute meaningfully to discussions by asking thoughtful questions and sharing your insights.
- Complete assignments and projects (if applicable): Demonstrate your ability to apply learned concepts to solve real-world problems or complete design projects (requirements will be outlined by the instructor).
- Maintain academic integrity: All work submitted must be your own. Uphold ethical standards as outlined in the university's academic integrity policy.
- Communicate effectively: Clearly express your ideas and solutions to problems, both verbally and in writing (if applicable).
- Work collaboratively (optional): Participate effectively in teamwork on assignments or projects, fostering a positive and supportive learning environment for your peers (if collaboration is a component of the course).
- Arrive on time to class: Respect your classmates and instructor by being punctual.
- Maintain a professional demeanor: Be respectful and engaged during class discussions and activities.
- Turn off electronic devices: Minimize distractions and focus on learning during class time.

Methods of Lecture Delivery/Teaching Aids

- Lecture Delivery Methods

Lecturing/Teaching Method

Educator-Student Interaction (Discussion method) Tutorial Method

Teaching Aids

Visual Aids (Use of PowerPoint slides)

COURSE CODE: MCT 203

COURSE TITLE: FUNDAMENTALS OF FLUID MECHANICS

S/N	ACTIVITIES	WEEKS
1.	**Introduction to Fluids** Definition of fluids (liquids and gases) Units and dimensions in fluid mechanics Fluid properties: density, viscosity, surface tension, vapor pressure Classification of fluids: Newtonian and non-Newtonian fluids **Activities** Laboratory experiments on density and viscosity measurement. Visualization of surface tension phenomena.	1-2

	Problem-solving exercises on unit conversions and fluid properties.	
2.	**Fluid Statics** Pressure: definition, units, hydrostatic pressure Pascal's Law and its applications Buoyancy and Archimedes' Principle Stability of submerged objects Applications of fluid statics in manometers and gauges **Activities** Demonstration of Pascal's Law using hydraulic press. Buoyancy experiments with different objects. Design projects on manometer applications. Problem-solving on pressure calculations and stability analysis.	3-4
3.	**Fluid Kinematics** Description of fluid motion: Eulerian and Lagrangian perspectives Streamlines, streaklines, pathlines Continuity equation: mass conservation principle Types of fluid flow: steady, unsteady, uniform, non-uniform, laminar, turbulent **Activities** Flow visualization techniques using smoke or dye tracers. Derivation and application of the continuity equation in practical problems. Animations or simulations of different flow types. Group discussions on real-world examples of various fluid flows.	5-7
4.	**Fluid Dynamics** Equation of motion (Bernoulli's equation): energy conservation principle Applications of Bernoulli's equation: Venturi meter, lift and drag Introduction to dimensional analysis and similitude Elementary potential flow theory **Activities** Demonstration of Bernoulli's principle with venturi meter setup. Case studies on lift and drag forces in airplane wings and race cars. Projects on applying dimensional analysis to fluid mechanics problems. Introduction to software tools for potential flow simulations (optional).	8-9
5.	**Introduction to Internal Flow** Pipe flow: Reynolds number, laminar and turbulent flow regimes Darcy-Weisbach equation and head loss calculations in pipes Minor losses in pipe systems: valves, bends, fittings Introduction to boundary layer theory: flow separation and drag	10-11

	Activities Design projects on pipe sizing and head loss calculations. Demonstrations of different flow regimes in pipes using flow visualization. Case studies on drag reduction techniques in pipelines or vehicles.	
6.	**Fluid Machinery** Introduction to pumps: types, classifications, working principles Energy transfer in pumps: pump head, efficiency Introduction to turbines: types, classifications, working principles Applications of pumps and turbines in various engineering fields **Activities** Field trip to a water treatment plant or pumping station (optional). Presentations and discussions on different pump and turbine technologies. Design projects on pump selection and sizing for specific applications.	12-13
7.	**Assessment** Weekly assignments and quizzes Midterm exam (covering weeks 1-6) Final exam (covering weeks 7-13) Project or term paper on a chosen fluid mechanics application	

Contemporary Issues and Industrial Relevance

By staying at the forefront of fluid mechanics research and applying its principles, industries can address contemporary challenges, improve efficiency, and develop innovative products that contribute to a more sustainable future. Hence, very relevant especially in the practice of mechatronics engineering to design and manufacture engineering components

BOWEN UNIVERSITY, IWO
Faculty of Engineering
Department of Mechatronics Engineering

Course Number: MCT 205
Course Title: Workshop 1
Semester: First
Credit Hours: 2 hours
Contact Hours: 2 hours lectures per Week
Location: Engineering Workshop
Lecturer(s): Engr. Dosumu & Prof. Adekunle

1. **Textbooks and other Materials**:
    1. Workshop Technology textbook or online resources.
    2. Workshop manuals for specific tools and equipment.
    3. Online tutorials and videos on workshop practices (optional).
    4. Well-equipped workshop with essential tools and machinery

2. **Course Description:**
Workshop Technology 1 introduces students to the foundational principles and practical skills required for success in a workshop environment. This course equips students with a strong foundation in workshop safety, enabling them to confidently operate various tools and equipment.
3. **Pre-requisites:** Physics, chemistry and Mathematics
4. **Co-requisite(s):** none
5. **Role in Curriculum:** Required (Engineering Topics)

Course Learning Outcome (CLO) and Programme Outcomes (PO)

Course Learning Outcomes: upon successful completion of the course, students should be able to:	Suitable Bloom Taxonomy Relevant to the CLOs	POs	Assessment Tools
Demonstrate a strong understanding of workshop safety principles and regulations.	2,3	1,2,3	Practicals & Quizzes
Apply safe work practices when using various measuring, marking, cutting, shaping, and joining tools.	3,4,5	1,2,3,5	Practicals & Assignments
Employ fitting and assembly techniques to create functional workshop tools or structures.	3,5	2,3,5,9	Practicals & Assignments

Effectively communicate technical information through drawings, sketches, and verbal descriptions.	3	3,10	Practicals, Quizzes and Assignments

Mapping of CLOs to POs

Course Learning Outcomes (CLOs)	Program Outcomes (POs)											
	1	2	3	4	5	6	7	8	9	10	11	12
Demonstrate a strong understanding of workshop safety principles and regulations.	2	3	3									
Apply safe work practices when using various measuring, marking, cutting, shaping, and joining tools.	2	3	3		2							
Employ fitting and assembly techniques to create functional workshop tools or structures.		3	3		2				3			
Effectively communicate technical information through drawings, sketches, and verbal descriptions.			2							3		

Keys: 1 = Slightly related, 2 = Moderately related, 3= Highly related

Course Status
Compulsory course

Expectations of Students
Basic Skills and Knowledge:

- A basic understanding of mathematics (arithmetic, geometry) will be helpful for calculations and measurements in the workshop.
- Prior exposure to technical drawings is beneficial, but not mandatory. The course will introduce students to interpreting basic workshop drawings and engineering specifications.
- Students should possess a willingness to learn and follow safety protocols for a safe and productive workshop environment.

Commitment and Work Ethic

- This course requires active participation and a hands-on approach. Students will be expected to attend lectures, actively participate in discussions, and complete workshop activities diligently.
- Completing assigned readings and familiarizing themselves with upcoming topics before workshops is highly encouraged.
- A strong work ethic and a commitment to following instructions are crucial for successful completion of projects and practical work.

Personal Qualities and Safety

- Students should possess a keen interest in learning practical workshop skills and applying them in projects.

- A positive attitude, teamwork skills, and the ability to collaborate effectively with peers are important for a successful learning experience.
- A strong commitment to safety is paramount. Students must be attentive during safety lectures, wear appropriate Personal Protective Equipment (PPE) when required, and adhere to all safety guidelines in the workshop environment.

Additional Considerations

- Students should show respect for the workshop equipment and tools by using them properly and taking care of them.
- Maintaining a clean and organized workspace is expected.
- Regular attendance and punctuality are essential for effective learning and participation.
- Open communication with the instructor regarding any questions, concerns, or difficulties is encouraged.

By fulfilling these expectations, students can maximize their learning experience in Workshop Technology 1 and develop a strong foundation for their future endeavors in the field.

Methods of Lecture Delivery/Teaching Aids

Lecture Delivery Methods

- **Interactive Lectures:** Lectures shouldn't be solely information dumps. Encourage student participation through:
    - **Question and Answer Sessions:** Regularly pause to allow students to ask questions and clarify any doubts.
    - **Case Studies and Problem-solving Scenarios:** Present real-world examples or hypothetical situations related to workshop practices. Guide students through problem analysis and potential solutions, prompting discussion and critical thinking.
    - **Clickers or Online Polling Tools:** Utilize audience response systems to engage students and gauge their understanding of key points.
- **Guest Lectures (Optional):** Invite industry professionals or workshop experts to share their practical experiences and insights. This can provide valuable real-world context and career guidance for students.
- **Flipped Classroom Approach (Optional):** Provide essential pre-recorded lectures or assign readings beforehand. Use class time for interactive activities, discussions, and hands-on practice related to the pre-learned content.

Teaching Aids:

- **Visual Aids:** Enhance presentations with engaging visuals like:
    - **PowerPoint Presentations:** Utilize clear and informative slides with diagrams, pictures, and animations to illustrate concepts.
    - **Technical Drawings & Schematics:** Project or display technical drawings, schematics, and engineering specifications relevant to the topics being discussed. Explain how to read and interpret these documents.
    - **Videos & Demonstrations:** Incorporate short video demonstrations of specific workshop techniques or equipment operation. You can also demonstrate some operations yourself in the classroom setting (ensuring safety protocols are followed).
- **3D Models & Simulations (Optional):** If available, utilize 3D models or simulation software to allow students to visualize workshop processes and equipment in a virtual environment.

- **Interactive Whiteboards/Projectors:** Use interactive whiteboards or projectors to enhance student engagement. Students can participate by drawing, annotating, or highlighting key points on projected materials.
- **Workshop Equipment & Tools:** The workshop itself is a valuable teaching aid. Regularly bring relevant tools or equipment into the classroom for demonstrations and discussions. Explain their functions, proper usage, and safety precautions.
- **Handouts & Course Materials:** Provide clear and concise handouts that summarize key points from lectures, safety protocols, or workshop procedures. Offer online resources (websites, tutorials) that students can access for further learning.

Course Content or Outline

S/N	ACTIVITIES	WEEKS

1	**Introduction & Workshop Safety**
	• Introduction to Workshop Technology: History, applications, career opportunities.
	• Workshop Safety:
	  o Safety regulations and personal protective equipment (PPE).
	  o Identification and mitigation of workshop hazards (electrical, mechanical, etc.).
	  o Safe work practices and emergency procedures.
		1-2

2	**Measuring & Marking Tools** • Introduction to various measuring tools (scales, rules, calipers, micrometers). • Techniques for accurate measurement and marking on different materials. • Introduction to engineering drawings and their interpretation. • Dimensioning and tolerancing practices.	2-4
3	**Measuring & Marking Tools** • Introduction to various measuring tools (scales, rules, calipers, micrometers). • Techniques for accurate measurement and marking on different materials. • Introduction to engineering drawings and their interpretation. • Dimensioning and tolerancing practices.	5-6
4	**Hand Tools & Basic Machining** • Introduction to common hand tools (hammers, saws, files, screwdrivers, wrenches). • Safe and proper use of hand tools for cutting, shaping, and finishing various materials (wood, metal, plastic).	7-8

	• Introduction to basic machining operations (drilling, tapping, threading).	
5	**Fabrication & Joining Techniques** • Sheet metalwork: cutting, bending, forming, and joining techniques. • Basic welding processes (optional, depending on resources). • Introduction to adhesives and mechanical fasteners for joining different materials. • Project: Fabrication of a simple workshop tool or structure.	9-10
6	**Introduction to Power Tools** • Introduction and safety considerations for power tools (drills, saws, grinders). • Proper techniques for using power tools for various workshop operations. • Maintenance and troubleshooting of basic power tools.	11-12
7	**Project Week & Assessment** • Individual or group project: Students design, fabricate, and assemble a functional workshop tool or object using the learned skills. • Final assessment: Practical skills demonstration, written exam on workshop theory and safety principles.	13

Teaching Methods:

- A combination of lectures, demonstrations, practical workshops, and project work will be used.
- Audiovisual aids (presentations, videos) will be incorporated to enhance understanding.
- Students will be encouraged to ask questions and participate actively in class discussions.

Assessment:

- Weekly assignments and quizzes on workshop theory and safety.
- Practical skills assessments during workshops.
- Final project evaluation based on design, functionality, and craftsmanship.
- Written exam on workshop principles and safety regulations.

Contemporary Issues and Industrial Application

Workshop Technology 1, while focusing on fundamental skills, can address contemporary issues and maintain industrial relevance by incorporating the following aspects:

1. Integration of Advanced Technologies:

- Introduce students to **Computer-Aided Design (CAD)** software to create basic workshop drawings and visualize project designs before fabrication.

- Briefly discuss how **Computer Aided Manufacturing (CAM)** is used in industry to automate certain workshop processes.

- Explore the use of **3D printing** for rapid prototyping and creating custom components in workshops.

2. Emphasis on Sustainability:

- Discuss the importance of **material selection** for efficient resource utilization and minimizing waste.

- Explore techniques for **reusing and recycling** materials in workshops.

- Highlight the growing importance of **energy efficiency** in workshops, focusing on using power tools and equipment responsibly.

3. Introduction to Industry 4.0 Concepts:

- Briefly introduce the concept of **Industry 4.0** and its focus on digitalization and automation in manufacturing.

- Discuss how workshop skills remain crucial even with advanced technologies, as human expertise is needed for setup, maintenance, and troubleshooting.

- Emphasize the growing need for workers with a **combination of technical skills and digital literacy**.

4. Addressing Safety in a Changing Environment:

- Discuss the increasing use of **robotics and automation** in workshops and highlight the importance of understanding safety protocols for working alongside these technologies.

- Emphasize the evolving nature of workshop safety due to the introduction of new tools and technologies.

- Encourage students to adopt a proactive approach to safety by staying updated on best practices and emerging hazards.

5. Adapting Skills to New Materials:

- Briefly discuss the growing use of **composite materials** and their unique properties in various industries.

- Introduce students to basic techniques for working with these materials while maintaining safety considerations.

- Encourage students to be open to learning new skills as technologies and materials evolve in the industrial landscape.

By incorporating these contemporary issues into Workshop Technology 1, students gain a better understanding of the changing industrial environment and how their fundamental workshop skills remain relevant in today's world. They will graduate with a foundation that prepares them to adapt to new technologies, prioritize safety in evolving environments, and contribute to a more sustainable future in various industries.

BOWEN UNIVERSITY, IWO
Faculty of Engineering
Department of Mechatronics Engineering

Course Number: MCT 206
Course Title: Workshop Technology II
Semester: Second
Credit Hours: 2 hours
Contact Hours: 2 hours lectures per Week
Location: Workshop Lab
Instructor(s): Engr. Dosumu, K.S.
Mr. Akintunde A. O**.**

Textbooks and other Materials:

i. **Workshop Technology** by RK Singal (This is a general suggestion, look for a textbook that aligns with your specific curriculum)
ii. **Machining for Dummies** by Kip Messenger (Beginner-friendly introduction to machining concepts)
iii. **Welding Essentials** by William A. Warrenton (Comprehensive guide to various welding processes)
iv. **Sheet Metal Work: Step-by-Step Techniques for Home Hobbyists** by Mark A. Denham (Practical guide to sheet metal fabrication).
v. **American Welding Society (AWS):** https://www.aws.org/ (Provides educational resources, welding standards, and certification information)
vi. **National Institute for Metalworking Skills (NIMS):** https://www.nims-skills.org/ (Offers industry-recognized credentials in various metalworking trades)

Course Description

Workshop Technology II builds upon the foundation you gained in Workshop Technology I, equipping you with advanced techniques in metalworking, machining, and fabrication. This course will allow you to:

- **Master essential welding processes:** Sharpen your Shielded Metal Arc Welding (SMAW) skills and explore Oxy-fuel Gas Welding (OFW) for cutting and brazing applications. Learn proper inspection methods to ensure high-quality welds.
- **Expand your machining expertise:** Operate lathes and milling machines with confidence, creating diverse shapes and features on metal workpieces. Gain an introduction to Computer-Aided Manufacturing (CAM) to prepare for the future of machining (optional).
- **Embrace sheet metal fabrication:** Delve into the world of sheet metal, understanding its properties and working methods. Learn layout techniques, cutting with shears and punching machines, and bending sheet metal to your desired form.
- **Design and build your own project:** Put your acquired skills into practice! Design and fabricate a real-world project using welding, machining, and sheet metal techniques. Document your process and showcase your creation in a final presentation.

Course Learning Outcome (CLO) and Programme Outcomes (PO)

Course Learning Outcomes: upon successful completion of the course, students should be able to:	Suitable Bloom Taxonomy Relevant to the CLOs	POs	Assessment Tools
Identify potential hazards associated with different workshop machines and processes.	1,2	1,2	
Demonstrate safe and proper use of Shielded Metal Arc Welding (SMAW) equipment.	2,4	3,4,5,9	Assignment, Quizzes & Exam
Operate a milling machine safely and effectively to perform basic milling tasks like facing, slotting, and pocketing using end mills (optional).	2,3,5	3,5,9	
Operate a lathe machine safely and accurately to produce various shapes (cylinders, cones, shoulders) on metal workpieces. Perform facing and knurling operations.	2,3,5	3,5,9	Assignment, Quizzes & Exam
Utilize shears and punching machines to cut sheet metal with precision.	3,5	2,3,5	Assignment, Quizzes & Exam
Design a small project utilizing the skills learned throughout the course (e.g., toolbox, phone stand, lamp).	3,5	3,5,9	Assignment, Quizzes & Exam
Present the completed project, explaining design choices and demonstrating its functionality.	3,5,6	3,5,9,11	Assignment, Quizzes & Exam

Mapping of CLOs to POs

	Program Outcomes (POs)											
Course Learning Outcomes (CLOs)	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Identify potential hazards associated with different workshop machines and processes.	3	2										
Demonstrate safe and proper use of Shielded Metal Arc Welding (SMAW) equipment.			2	3	3				3			
Operate a milling machine safely and effectively to perform basic milling tasks			2		3				2			

like facing, slotting, and pocketing using end mills (optional).												
Operate a lathe machine safely and accurately to produce various shapes (cylinders, cones, shoulders) on metal workpieces. Perform facing and knurling operations.			2		3				3			
Utilize shears and punching machines to cut sheet metal with precision.		2	2		3							
Design a small project utilizing the skills learned throughout the course (e.g., toolbox, phone stand, lamp).			3		3				3			
Present the completed project, explaining design choices and demonstrating its functionality.			2		3				2			

Keys: 1 = Slightly related, 2 = Moderately related, 3= Highly related

Module Structure (Weekly Breakdown):

S/N	ACTIVITIES	WEEKS
1	**Introduction & Review** • Workshop safety refresher (proper use of PPE, machine operation guidelines, hazard identification) • Review of metal properties and their influence on machining processes • Introduction to advanced machining techniques (drilling, threading, milling)	1-2
2	**Welding** • Shielded Metal Arc Welding (SMAW) - theory, electrode selection, practice on various weld joints • Oxy-fuel Gas Welding (OFW) - theory, safety precautions, cutting and brazing techniques • Welding inspection and quality control procedures	3-5
3	**Machining** • Lathe machine operation - turning various shapes (cylinders, cones, shoulders), facing, knurling • Milling machine operation - basic milling concepts, facing, slotting, pocketing using end mills • Computer-Aided Manufacturing (CAM) introduction - using CAM software to generate toolpaths for CNC machining (optional)	6-8

4	**Sheet Metal Fabrication** • Sheet metal properties and selection for different applications • Layout techniques for sheet metal development • Sheet metal cutting using shears and punching machines • Bending techniques using sheet metal folders	9-10
5	**Project Design and Fabrication** • Students design a small project utilizing skills learned throughout the course (e.g., toolbox, phone stand, lamp) • Develop detailed workshop drawings with dimensions and specifications • Fabrication of the project using appropriate techniques (welding, machining, sheet metalwork)	11-12
6	**Project Demonstration & Assessment** • Students present their completed projects, explaining design choices and fabrication processes. • Assessment based on project functionality, quality of workmanship, adherence to safety procedures, and project reports.	13

Assessment:
- Weekly assignments (drawing exercises, quizzes).
- Mid-term exam (covering weeks 1-7).
- Final project (creating a complete engineering project).

Teaching Methods:

1. Blended Learning Approach:
- **Interactive lectures:**
  - Use clear explanations, demonstrations, and visuals (diagrams, animations, videos) to introduce key concepts, safety protocols, and theoretical foundations for each topic (welding, machining, sheet metal fabrication).
  - Encourage in-class discussions and answer student questions to ensure understanding.
  - Consider using flipped classroom techniques where students watch pre-recorded lectures outside of class and use class time for active learning activities.
- **Hands-on Workshops:**
  - This is the core of the course. Provide clear and concise instructions before each practical activity.
  - Divide complex tasks into smaller, achievable steps to guide students through the learning process.
  - Ensure a well-equipped workshop with proper ventilation and lighting.
  - Facilitate student learning by providing individual guidance and feedback as they practice their skills.
  - Encourage collaboration and teamwork during projects where students can learn from each other.

2. Project-Based Learning:
- Dedicate a significant portion of the course to a project where students design and fabricate a small object using the learned skills.

- This allows students to:
    - Apply theoretical knowledge to a practical scenario.
    - Develop problem-solving and critical thinking skills to overcome challenges during project development.
    - Practice project management skills like planning, budgeting, and time management.
    - Enhance their creativity and design thinking abilities.
- Offer several project options with varying difficulty levels to cater to diverse student interests and skill sets.
- Provide regular check-ins and feedback sessions to keep students on track and address any concerns.

3. Active Learning Strategies:

- Incorporate a variety of activities to keep students engaged and promote deeper learning:
    - **Case studies:** Present real-world scenarios related to welding, machining, or fabrication for students to analyze and discuss potential solutions.
    - **Simulations:** Utilize workshop simulators (if available) to provide students with a safe environment to practice their skills before working with actual machines.
    - **Problem-solving exercises:** Present students with technical problems related to different processes and have them work in teams to find solutions.
    - **Debates:** Facilitate debates on relevant topics like the future of metalworking or the impact of automation on manufacturing jobs.

4. Technology Integration:

- Utilize technology to enhance learning:
    - **3D Modeling Software (Optional):** Introduce students to basic 3D modeling software to create digital models of their project designs.
    - **Educational Videos:** Supplement lectures with short, engaging videos that demonstrate specific welding, machining, or fabrication techniques.
    - **Online Resources:** Provide access to online resources like tutorials, safety guidelines, and industry news to encourage further exploration.
    - **Presentation Software:** Guide students on using presentation software to showcase their completed projects and effectively communicate their design choices and fabrication process.

5. Assessment Strategies:

- Move beyond traditional exams and incorporate a variety of assessment methods:
    - **Performance-based assessments:** Evaluate students' practical skills through observed performance during workshop activities and project fabrication.
    - **Project reports:** Require students to document their project development process, including design considerations, challenges encountered, and solutions implemented.
    - **Presentations:** Have students present their completed projects, explaining their design rationale, fabrication techniques, and lessons learned.
    - **Quizzes and assignments:** Utilize regular quizzes and assignments to assess understanding of key theoretical concepts and safety procedures.

j) Method of Grading Continuous Assessment

Continuous Assessment Test 1: 10%

Continuous Assessment Test 2 (Test): 20%

End of Semester Examination : 70%

k) Tutorials

- End of Week 2: Tutorial 1 (Moodle 1 & Moodle 2)
- End of Week 9: Tutorial 2 (Moodle 3 to Moodle 5)
- End of Week 12: Tutorial 3 (Moodle 6)
- Week 12: End of Semester Tutorials

m) Contemporary Issues and Industrial Relevance

Workshop Technology II plays a crucial role in equipping students with the skills necessary to navigate the ever-evolving landscape of manufacturing. Here's a breakdown of some key contemporary issues and their connection to the industrial relevance of the course:

Contemporary Issues:

- **Automation and Robotics:** The rise of automation and robotics is transforming manufacturing processes. While some manual jobs may be replaced, there's a growing demand for skilled workers who can operate, maintain, and program these automated systems. Workshop Technology II provides a foundation for understanding these technologies and their integration with traditional workshop skills.
- **Additive Manufacturing (3D Printing):** Additive manufacturing is revolutionizing prototyping and small-scale production. Understanding how to design for 3D printing and potentially even operate basic 3D printers within the workshop can give students a competitive edge.
- **Sustainability in Manufacturing:** Environmental concerns are driving a push for sustainable manufacturing practices. The course can highlight the importance of using eco-friendly materials, minimizing waste, and optimizing energy consumption during workshop processes.
- **Supply Chain Disruptions:** Recent global events have highlighted the vulnerabilities of complex supply chains. Workshop skills empower individuals to become more self-sufficient and create solutions using readily available materials.

Industrial Relevance of Workshop Technology II:

- **Adaptability and Versatility:** Workshop skills equip students to adapt to changing job requirements within the manufacturing sector. Being skilled in welding, machining, and fabrication allows them to work on diverse projects and troubleshoot unexpected challenges.
- **Problem-solving and Critical Thinking:** These skills are crucial for success in any industry. Students in Workshop Technology II learn to analyze problems, identify potential solutions, and apply their technical knowledge to overcome challenges during project development and fabrication.
- **Technological Integration:** The course can introduce students to how traditional workshop skills are combined with modern technologies like 3D modeling and Computer-Aided Manufacturing (CAM). This understanding prepares them for the future of manufacturing where digital tools play an increasingly important role.
- **Entrepreneurship and Innovation:** Workshop skills empower individuals to become self-employed or create innovative products. Students can use their acquired knowledge to design and fabricate prototypes, launch small businesses, or contribute to the maker movement.

Incorporating these contemporary issues into your course curriculum can make Workshop Technology II even more relevant for students. By highlighting the evolving nature of manufacturing and the ongoing demand for skilled technicians, you can inspire students and demonstrate the practical value of the course content in their future careers.

Here are some suggestions for integrating these issues:

- **Case studies:** Present real-world examples of how automation, 3D printing, or sustainability practices are impacting manufacturing processes.
- **Guest speakers:** Invite industry professionals to speak about their experiences and the skills they value in potential employees.
- **Project ideas:** Encourage students to consider these issues during their project design phase. Can they incorporate sustainable materials? Design a product that can be easily repaired or manufactured using 3D printing techniques?

BOWEN UNIVERSITY, IWO

Faculty of Engineering

Department of Mechatronics Engineering

Course Number: MCT 207
Course Title: Python for Engineers
Semester: First
Credit Hours: 2 hours
Contact Hours: 2 hours lectures per Week
Location: New Horizon
Lecturer(s): **Kehinde O. E**

Textbooks and other Materials:

1. Qingkai Kong, Timmy Siauw and Alexandre M. Bayen (2021), Python Programming and Numerical Methods: A Guide for Engineers and Scientists.
2. Learn Complete Python in Simple Way. Durga Software Solution.
3. Hans Fangohr (2015), Introduction to Python for Computational Science and Engineering (A beginner's guide)

Course Description

Python is a beneficial language for use in a lot of development projects. In this course, the students will learn the basics of Python programming. They start by installing Python on their local machine or mobile phone and practice writing code using the Python shell. Next, they perform basic math and logical operations in Python. The students will create Python variables and see how they can assign and access values stored in those variables. They will then use built-in functions, which are part of the core Python programming language, to perform simple calculations and operations. Finally, the students explore strings in Python work, creating strings using single, double, and triple quotes depending on the use case. They will then briefly examine the use of complex data types, such as lists, tuples, sets, and dictionaries. When the students finish this course, they will be able to execute simple Python commands on Jupiter notebooks.

Course Learning Outcome (CLO) and Programme Outcomes (PO)

Course Learning Outcomes: upon successful completion of the course, students should be able to:	Suitable Bloom Taxonomy Relevant to the CLOs	POs	Assessment Tools
To understand the basic principles python programming.	2,3	1,2	Practicals & Quizzes
Understand core Python syntax, data structures, and control flow.	3,4,5	1,2,3,5	Practicals & Assignments
Apply functions, loops, and object-oriented programming principles.	3,5	2,3,5	Practicals & Assignments
Work with common Python libraries for various tasks.	3,4,5	3,4,5	Practicals, Quizzes and Assignments

Mapping of CLOs to POs

Course Learning Outcomes (CLOs)	Program Outcomes (POs)											
	1	2	3	4	5	6	7	8	9	10	11	12
To understand the basic principles python programming.	2	3										
Understand core Python syntax, data structures, and control flow.	2	3	3		2							
Apply functions, loops, and object-oriented programming principles.		2	3		3							
Work with common Python libraries for various tasks.			3	2	3							

Keys: 1 = Slightly related, 2 = Moderately related, 3= Highly related

Course Status

Compulsory course

Expectations of students

To ensure a successful learning experience, here are the expectations for students:

- Regular attendance: Actively participate in lectures, discussions, and in-class activities.
- Come prepared: Review assigned readings and complete any pre-class activities before each lecture.
- Take comprehensive notes: Pay close attention during lectures and actively participate in discussions.
- Practice problem-solving: Regularly work on assigned problems and practice exercises to solidify your understanding.
- Seek clarification: Don't hesitate to ask questions during lectures, office hours, or via email if you need clarification on any concepts.

- Complete all quizzes and exams: Demonstrate your understanding of the course material through scheduled assessments.
- Actively participate in class discussions: Contribute meaningfully to discussions by asking thoughtful questions and sharing your insights.
- Complete assignments and projects (if applicable): Demonstrate ability to apply learned concepts to solve real-world problems or complete design projects (requirements will be outlined by the instructor).
- Maintain academic integrity: All work submitted must be your own. Uphold ethical standards as outlined in the university's academic integrity policy.
- Communicate effectively: Clearly express your ideas and solutions to problems, both verbally and in writing (if applicable).
- Work collaboratively (optional): Participate effectively in teamwork on assignments or projects, fostering a positive and supportive learning environment for your peers (if collaboration is a component of the course).
- Arrive on time to class: Respect your classmates and instructor by being punctual.
- Maintain a professional demeanor: Be respectful and engaged during class discussions and activities.

Methods of Lecture Delivery/Teaching Aids

Lecture Delivery Methods

- Lecturing/Teaching Method
- Educator-Student Interaction (Discussion method) Tutorial Method

Teaching Aids

Visual Aids (Use of PowerPoint slides)

Course Content or Outline

S/N	ACTIVITIES	WEEKS
1	**Introduction to Python** • Introduction to programming concepts • Setting up Python development environment • Basic syntax: variables, data types, operators • Input and output functions	1 and 2
`2	**Control Flow Statements** • Conditional statements (if/else, elif) • Looping constructs (for, while) • Nested loops and conditional statements	3 and 4
3	**Functions and Modules** • Defining and calling functions • Passing arguments and returning values • Introduction to modules and importing code	5 and 6
4	**Midterm Exam** • Exam covering concepts from Weeks 1-6	7

5	**Strings and String Manipulation** • Working with strings: concatenation, indexing, slicing • String formatting and methods • Regular expressions (basic introduction)	8
6	**Lists and Tuples** • Creating, accessing, and modifying lists • List comprehensions for concise list creation • Working with tuples (immutable lists)	9
6	**Dictionaries and Sets** • Creating and manipulating dictionaries (key-value pairs) • Set operations (union, intersection, difference) • Working with common data structures in Python	10
8	**Introduction to Object-Oriented Programming (OOP)** • Defining classes and objects • Attributes, methods, and object behavior • Understanding inheritance and polymorphism	11
9	**Project Presentations** • Students present their projects showcasing their Python skills	12
10	**Course Review and Final Exam** • Review of key concepts and course material • Final exam covering comprehensive Python knowledge	13

Teaching Methods:

- A combination of lectures, demonstrations, will be used.
- Audiovisual aids (presentations, videos) will be incorporated to enhance understanding.
- Students will be encouraged to ask questions and participate actively in class discussions.

Assessment:

- Weekly assignments and quizzes
- Mid semester exam
- Final project evaluation based on design and functionality
- Examination

Industrial Application

Machine automation
Robot navigation
Web development
Machine learning
Game development
IoT

BOWEN UNIVERSITY, IWO

Department of Mechatronics Engineering

Course Number: MCT 209

Course Title: Engineering Mechanics 1

Semester: First

Credit Hours: 2 hours

Contact Hours: 2 hours lectures per Week

Location: New Horizon

Lecturer(s): Engr. Dr. A.O. Onokwai

1. **Textbooks and other Materials**:

i. **Engineering Mechanics: Statics** by Ferdinand P. Beer and E. Russell Johnston Jr. (Publisher: McGraw-Hill Education) - This is a widely used textbook known for its clear explanations and well-structured examples.

ii. **Engineering Mechanics: Statics** by R.C. Hibbeler (Publisher: Pearson) - Another classic textbook with a strong focus on problem-solving techniques.

iii. **Statics** by J.L. Meriam and L.G. Kraige (Publisher: Wiley) - A comprehensive textbook with a good balance of theory and application examples.

iv. **Engineering Mechanics 1: Statics** by Dietmar Gross et al. (Publisher: Springer) - Offers a more concise and mathematically rigorous approach to mechanics.

Course Description:

Engineering Mechanics 1 is a foundational course for all engineering disciplines. It introduces students to the fundamental principles of mechanics, focusing on analyzing forces and their effects on structures and objects in equilibrium.

The course emphasizes applying these principles to solve real-world engineering problems. Students will develop critical problem-solving skills and gain a strong understanding of:

- **Vector mechanics:** Analyze forces, moments, and other quantities using vectors.
- **Equilibrium:** Apply equilibrium equations ($\Sigma F_x = 0$, $\Sigma F_y = 0$, $\Sigma M = 0$) to solve problems involving static objects.
- **Analysis of structures:** Analyze trusses, frames, and beams to determine internal forces acting on them.
- **Centroids and moments of inertia:** Calculate the center of gravity and moment of inertia for various shapes, essential for analyzing structures.
- **Work and energy:** Apply the work-energy principle to analyze the motion of objects, considering kinetic and potential energy.
- **Impulse and momentum:** Utilize the impulse-momentum principle to solve problems involving moving objects, including collisions.

Course Learning Outcome (CLO) and Programme Outcomes (PO)

Course Learning Outcomes: upon successful completion of the course, students should be able to:	**Suitable Bloom Taxonomy Relevant to the CLOs**	**POs**	**Assessment Tools**
Define scalars and vectors, and perform basic vector operations (addition, subtraction, dot product, cross product).	2,3	1,2	Assignment, Quizzes & Exam
Explain the concept of force, units, and dimensions.	3,4,5	1,2,3	Assignment, Quizzes & Exam
Analyze simple trusses using the method of joints and the method of sections.	3,5	2,3,5	Assignment, Quizzes & Exam
Explain the work-energy principle and its application to solve problems involving kinetic and potential energy.	3	2,3,4	Assignment, Quizzes & Exam
Apply the concepts of engineering mechanics to analyze real-world engineering structures like bridges, machines, and robots.	3,4,5	3,4,5	Assignment, Quizzes & Exam

Mapping of CLOs to POs

Course Learning Outcomes (CLOs)	**Program Outcomes (POs)**											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Define scalars and vectors, and perform basic vector operations (addition, subtraction, dot product, cross product).	2	3										
Explain the concept of force, units, and dimensions.	2	3	3									
Analyze simple trusses using the method of joints and the method of sections.		3	2		2							
Explain the work-energy principle and its application to solve problems involving kinetic and potential energy.		3	3	2								
Apply the concepts of engineering mechanics to analyze real-world engineering structures like bridges, machines, and robots.			3	2	3							

Keys: 1 = Slightly related, 2 = Moderately related, 3= Highly related

Course work will include:

- Lectures introducing key concepts and principles.
- Tutorials providing opportunities to practice problem-solving.
- Assignments to reinforce understanding and apply concepts to different scenarios.
- Quizzes to assess student comprehension throughout the semester.
- (Optional) Projects allowing students to apply mechanics principles to specific engineering problems.

This course is a prerequisite for many upper-level engineering courses in areas like structural mechanics, machine design, and robotics.

Course Status
Compulsory course

Expectations of Students
This course is designed for students who are:

- Entering their second year (200 level) of an engineering program.
- Possess a strong foundation in mathematics, particularly algebra, trigonometry, and basic calculus (familiarity with derivatives and integrals).
- Prepared to actively participate in lectures, tutorials, and group discussions.
- Committed to dedicating time outside of class to studying the material, completing assignments, and practicing problem-solving techniques.

Basic Skills and Knowledge Required for Engineering Mechanics 1

Success in Engineering Mechanics 1 hinges on a strong foundation in several key areas. Here's what students should be familiar with before taking the course:

Mathematics:

- **Algebra:** Manipulating equations, solving for unknowns, understanding exponents and logarithms.
- **Trigonometry:** Using trigonometric functions (sine, cosine, tangent) to solve problems involving angles and right-angled triangles.
- **Basic Calculus (optional, but highly beneficial):** Understanding derivatives (rates of change) and integrals (accumulation) can significantly enhance problem-solving abilities.

Problem-Solving Skills:

- **Analytical Thinking:** Breaking down complex problems into smaller, manageable steps.
- **Logical Reasoning:** Applying logical deductions and rules to arrive at correct solutions.
- **Visualization:** Creating visual representations of problems (diagrams, sketches) to aid understanding.

Technical Skills:

- **Unit Systems and Conversions:** Understanding different unit systems (SI units, Imperial units) and performing unit conversions.
- **Technical Drawings:** Interpreting basic engineering drawings to understand geometry and dimensions of objects.

Additional Skills:

- **Time Management:** Effectively managing time to complete coursework, assignments, and studying.
- **Independent Learning:** Taking initiative to learn concepts outside of class and seek help when needed.
- **Scientific Notation:** Expressing numbers in scientific notation for easier calculations.

Prior Knowledge (helpful, but not mandatory):

- **Basic Physics:** Familiarity with concepts like force, motion, and energy can provide a helpful foundation.

Methods of Lecture Delivery/Teaching Aids

Lecture Delivery Methods:

- **Traditional Lecture:** This classic method provides a structured overview of key concepts. However, consider incorporating interactive elements to maintain student engagement.
- **Flipped Classroom:** Provide students with pre-recorded lectures or online resources to review outside of class. Use class time for interactive activities, problem-solving sessions, and discussions.
- **Peer Instruction:** Pose questions throughout the lecture and have students discuss them with peers. This encourages active learning and clarifies understanding.
- **Case Studies:** Present real-world engineering problems and guide students through applying mechanics principles to find solutions. This demonstrates the practical applications of the course material.

Teaching Aids:

- **Visual Aids:** Utilize presentations with clear illustrations, diagrams, and animations to enhance understanding of abstract concepts.
- **Whiteboard/Blackboard:** Although traditional, these tools allow for interactive problem-solving demonstrations and student participation.
- **Physical Models:** 3D models of structures or mechanisms can help students visualize forces and their effects.
- **Software Demonstrations:** Showcase relevant engineering mechanics software and demonstrate how it can be used to solve problems.
- **In-class Activities and Experiments:** Design simple experiments or activities that allow students to apply mechanics principles in a hands-on way.
- **Clickers or Online Polling Tools:** Encourage audience participation and gauge student understanding through real-time polls and quizzes.

Course Content or Outline

S/N	ACTIVITIES	WEEKS
1	**Introduction to Mechanics** • Introduction to engineering mechanics and its applications in various engineering disciplines. • Fundamental concepts: Scalars and vectors, force, units and dimensions, Newton's Laws of Motion. • Free body diagrams, equilibrium conditions (2D and 3D).	1-2

	• Solving problems using equilibrium equations (2D and 3D).	
2	**Internal Forces and Applications** • Trusses: Analysis of simple trusses using method of joints and method of sections. • Frames: Analysis of two-force members and frames. • Shear force and bending moment diagrams for beams. • Relationship between shear force, bending moment, and distributed load.	3-4
3	**Centroids and Moments of Inertia** • Centroids and centers of gravity of geometric shapes and composite bodies. • Moment of inertia: Area moment of inertia, mass moment of inertia, parallel axis theorem, perpendicular axis theorem. • Applications of centroids and moments of inertia to engineering problems.	5-6
4	**Work and Energy** • Work done by a force, different types of work (linear, rotational). • Work-energy principle, kinetic energy, potential energy, conservative and non-conservative forces. • Applications of work-energy principle to solve engineering problems.	7-8
5	**Impulse and Momentum** • Linear momentum, impulse-momentum principle. • Collisions (perfectly inelastic and elastic collisions) in one dimension. • Applications of impulse-momentum principle to solve engineering problems	9-10
6	**Applications and Case Studies** • Applications of engineering mechanics to real-world problems (bridges, machines, robots). • Introduction to friction: Static and kinetic friction, coefficient of friction. • Case studies and problem-solving sessions.	11-12
7	**Review and Assessment** • Review of key concepts covered throughout the course.	13

	• Final assessment (combination of quizzes, assignments, and a final exam).	

Teaching Methods:

- Lectures: Introduce key concepts and principles.
- Tutorials: Solve problems and practice applying concepts.
- Assignments: Individual and group assignments to reinforce learning.
- Quizzes: Short, in-class quizzes to assess understanding.
- Projects (Optional): Allow students to apply mechanics concepts to a specific engineering problem.

Assessment:

- **Class Participation (5-10%):** Encourage active learning and participation through discussions, peer instruction, and clicker questions. Award points for insightful contributions, explanations, and engagement.
- **Homework Assignments (20-30%):** Design regular assignments that reinforce learning and provide practice applying concepts to various problems. Consider offering peer review opportunities for these assignments.
- **Quizzes (10-20%):** Short, in-class quizzes can assess student comprehension of recently covered topics and identify areas needing further explanation.
- **Midterm Exam (20-30%):** A comprehensive exam halfway through the semester allows you to gauge student understanding of the first half of the course material and identify areas where students may be struggling.
- **Final Exam (20-30%):** A comprehensive final exam assesses overall knowledge and problem-solving skills across the entire course.
- **Projects (Optional, 10-20%):** Consider incorporating a project where students apply mechanics principles to a specific engineering problem. This allows them to demonstrate knowledge, creativity, and communication skills.

Contemporary Issues:

- **Sustainable Design:** As the world focuses on sustainability, engineering mechanics principles are used to design structures and machines that are lightweight, energy-efficient, and minimize environmental impact. For example, analyzing forces and stresses in wind turbine blades helps ensure their structural integrity and optimize their efficiency in capturing wind energy.

- **Resilient Infrastructure:** With increasing concerns about natural disasters and climate change, engineers are designing infrastructure (bridges, buildings) that can withstand extreme loads and seismic activity. Engineering mechanics principles are used to analyze these structures and ensure they can resist these forces without failure.
- **Additive Manufacturing (3D Printing):** The growing popularity of 3D printing requires a deep understanding of mechanics to design objects with the necessary strength and functionality. Analyzing stress distribution and optimizing material usage for 3D printed components relies heavily on engineering mechanics principles.

Industrial Applications:

- **Robotics:** The field of robotics heavily relies on mechanics principles for robot design, motion control, and manipulation tasks. Expand more understanding forces, moments, and center of gravity is crucial for designing robots that can move with precision and stability.

- **Biomechanics:** Engineering mechanics principles are applied in biomechanics to analyze forces acting on the human body, develop prosthetics and orthotics, and understand the mechanics of human movement.
- **Aerospace Engineering:** From designing airplanes that can handle aerodynamic forces to analyzing the stresses on spacecraft during launch, engineering mechanics is fundamental to the entire aerospace industry.
- **Automotive Engineering:** From suspension systems that ensure smooth handling to crashworthiness testing, engineering mechanics plays a vital role in designing safe and efficient vehicles.
- **Civil Engineering:** From analyzing forces on bridges and buildings to designing earthquake-resistant structures, civil engineers rely on engineering mechanics principles to ensure the safety and functionality of their projects.

BOWEN UNIVERSITY, IWO

Faculty of Engineering

Department of Mechatronics Engineering

Course Number: MCT 211 **Course Title:** Strength of Materials

Semester: First **Credit Hours**: 2 hours

Contact Hours: 2 hours lectures per Week

Location: New Horizon **Lecturer(s)**: Dr. S.A Ajayi

Text books and other Materials:

1. Mechanics of Machines. James M. Gere. United States, Sixth Edition, 2004.
2. Strength of Materials (Mechanics of Solids). R. K. Rajput. New Delhi, First Edition, 1998.
3. Mechanics of Structures Vol. II by S. B. Junnarkar and Dr. H. J. Shah, Twenty-second edition, Charotar Publishing House.
4. Strength of materials by D. Ghosh A. K. Datta, New Age International Publishers.
5. Applied Strength of Materials for Engineering Technology, 15^{th} ed. Barry Dupen 2018.
6. Schaum's Outline of Strength of Materials, seventh Edition. Merle Potter, William Nash. 2019.

Course Overview

This course equips you with the fundamental knowledge of how materials behave under various loads and stresses. It delves into the analysis of forces, deformations, and the material properties that influence their response. By the end, you'll gain a strong foundation for designing safe and efficient structures.

Course Description

The course starts with the key concepts of stress, strain, and deformation, the fundamental building blocks of Strength of Materials. It explores the mechanical properties of different materials like metals, plastics, and composites, understanding how they react to tension, compression, and shear forces. Moving forward, master the analysis of axial loading, a crucial concept for understanding how bars and beams behave under tension and compression. Hooke's Law, a cornerstone of elasticity, will be applied to solve problems involving axial stress, strain, and deformation. The course delves deeper into different loading scenarios. The students will learn about shear stress and strain, analyzing forces acting on beams, rivets, and bolts. Understanding torsional loading becomes crucial as you examine the behavior of shafts subjected to twisting forces. Deflection and buckling are explored in later weeks. Also how to calculate how beams bend under different loads and how to prevent catastrophic buckling failures in columns. Failure theories, like Von Mises and Tresca criteria, are introduced to predict material behavior under combined loading conditions.

Course Learning Outcome (CLO) and Programme Outcomes (PO)

Course Learning Outcomes: upon successful completion of the course, students should be able to:	**Suitable Bloom Taxonomy Relevant to the CLOs**	**POs**	**Assessment Tools**
Grasp the core principles of Strength of Materials: Understand how stress, strain, and deformation relate to material behavior under load.	1,2	1,2,3	Practical, Assignment, Quizzes & Exam
Differentiate between various material properties: Analyze tensile strength, yield strength, Young's modulus, Poisson's ratio, and their impact on material response.	4	2,3	Practical, Assignment, Quizzes & Exam
Comprehend shear stress and strain: Analyze shear forces acting on beams, rivets, and bolts, calculating shear stress and strain for different materials.	2,3,4	1,2,3	Practical, Assignment, Quizzes & Exam
Calculate beam deflection: Utilize formulas and engineering tools to analyze how beams bend under various loading conditions.	3,4	2,3,4	Practical, Assignment, Quizzes & Exam
Design simple structures: Apply the learned concepts to design simple beams, columns, and other structural elements considering load-bearing capacities and deflection limitations.	3,5	2,3,4	Practical, Assignment, Quizzes & Exam
Effectively communicate engineering concepts: Clearly explain your understanding of stress, strain, and design considerations in written and oral formats (optional).	1,2	3,10	Practical, Assignment, Quizzes & Exam
Collaborate with peers: Work effectively in teams on assignments or projects, fostering a positive learning environment (optional).	5	3,4,9	Practical, Assignment, Quizzes & Exam

Mapping of CLOs to POs

Course Learning Outcomes (CLOs)	Program Outcomes (POs)											
	1	2	3	4	5	6	7	8	9	10	11	12
Grasp the core principles of Strength of Materials: Understand how stress, strain, and deformation relate to material behavior under load.	3	2	2									
Differentiate between various material properties: Analyze tensile strength, yield strength, Young's modulus, Poisson's ratio, and their impact on material response.		3	2									
Comprehend shear stress and strain: Analyze shear forces acting on beams, rivets, and bolts, calculating shear stress and strain for different materials.	3	3	2									
Calculate beam deflection: Utilize formulas and engineering tools to analyze how beams bend under various loading conditions.		3	3	2								
Design simple structures: Apply the learned concepts to design simple beams, columns, and other structural elements considering load-bearing capacities and deflection limitations.		3	3	2								
Effectively communicate engineering concepts: Clearly explain your understanding of stress, strain, and design considerations in written and oral formats (optional).			2							3		
Collaborate with peers: Work effectively in teams on assignments or projects, fostering a positive learning environment (optional).			3	2					3			

Keys: 1 = Slightly related, 2 = Moderately related, 3= Highly related

Course Status

Compulsory course

Expectations of Students

This course requires a strong foundation in mathematics (algebra, trigonometry, calculus) and a commitment to active learning. To ensure a successful and rewarding learning experience, here are the expectations for students:

- Regular attendance: Actively participate in lectures, discussions, and in-class activities.
- Come prepared: Review assigned readings (textbooks, articles, online resources) and complete any pre-class activities before each lecture.
- Complete all assigned readings: Actively engage with the course material to solidify your understanding.
- Take comprehensive notes: Pay close attention during lectures and actively participate in discussions.
- Practice problem-solving: Regularly work on assigned problems and practice exercises to apply the learned concepts.
- Seek clarification: Don't hesitate to ask questions during lectures, office hours, or via email if you need clarification on any concepts.
- Complete all quizzes and exams: Demonstrate your understanding of the course material through scheduled assessments.
- Actively participate in class discussions: Ask thoughtful questions, share your insights, and contribute effectively to discussions.
- Complete assignments and projects (if applicable): Apply learned concepts to solve real-world problems or design simple structures as per instructor requirements.
- Maintain academic integrity: All work submitted must be your own. Uphold ethical standards as outlined in the university's academic integrity policy.
- Communicate effectively: Clearly express your ideas and solutions to problems, both verbally and in writing (if applicable).
- Work collaboratively (optional): Participate effectively in teamwork on assignments or projects, fostering a positive and supportive learning environment for your peers (if collaboration is a component of the course).
- Arrive on time to class: Respect your classmates and instructor by being punctual.
- Maintain a professional demeanor: Be respectful and engaged during class discussions and activities.
- Minimize distractions: Turn off electronic devices that are not relevant to the course during class time.

Methods of Lecture Delivery/Teaching Aids

- Lecture Delivery Methods

Lecturing/Teaching Method

Educator-Student Interaction (Discussion method) Tutorial Method

- Teaching Aids

Visual Aids (Use of PowerPoint slides)

S/N	ACTIVITIES	WEEKS

1	**Introduction to Strength of Materials** Definition of Strength of Materials and its importance in engineering design. Basic concepts of stress (normal and shear), strain (axial, shear), and deformation. Units and dimensions used in strength of materials calculations. Mechanical properties of materials: tensile strength, yield strength, Young's modulus, Poisson's ratio. **Activities** Laboratory experiments on tensile testing of materials. Visualization of stress-strain diagrams for different materials. Problem-solving exercises on unit conversions and material properties calculations. Group discussions on real-world examples of material behavior under load.	1-2
2	**Mechanical Behavior of Materials** Stress-strain relationships for different materials: elastic, plastic, and brittle behavior. Hooke's Law: proportionality between stress and strain for elastic materials. Introduction to the concept of a stress-strain diagram and its interpretation. Elastic limit, yield point, and ultimate strength of materials. **Activities:** Case studies on material selection based on stress-strain behavior. Analysis of real-world data from tensile testing experiments. Animations or simulations of material deformation under stress. Design projects on simple structures considering material limitations.	3-4
3	**Axial Loading** Analysis of axial members under tension and compression. Application of Hooke's Law to solve problems involving axial stress, strain, and deformation. Statically determinate and indeterminate problems. Introduction to the concept of safety factor in design. **Activities** Design exercises involving sizing of bars under axial loads. Problem-solving sessions on axial stress and strain calculations for various materials. Demonstration of static equilibrium principles in axial loading scenarios.	5-6

	Midterm exam (covering weeks 1-6 material)	
4	**Shear Stress and Strain** Introduction to shear stress and shear strain in different materials. Applications of shear stress and strain analysis in beams, rivets, and bolts. Relationship between shear stress and shear strain for various materials. Introduction to the concept of modulus of rigidity. **Activities** Laboratory demonstrations of shear testing experiments. Design projects on analyzing shear forces and stresses in simple structures. Problem-solving exercises on calculating shear stress and strain in different scenarios. Guest lecture from an industry professional on material selection for shear applications (optional).	7-8
5	**Torsional Loading** Analysis of circular shafts subjected to torsional loading. Torsional stress and strain calculation for shafts. Relationship between torque, polar moment of inertia, and angle of twist. Design considerations for shafts under torsional loading. **Activities** Design exercises on sizing shafts based on torque and stress limitations. Problem-solving sessions on analyzing torsional stress and strain in shafts. Simulations or animations of torsional deformation in shafts. Field trip to a manufacturing facility that utilizes shafts (optional).	9-10
6	**Deflection and Buckling** Introduction to the concept of deflection in beams under different loading conditions. Beam deflection calculations using simple formulas and engineering handbooks. Euler buckling theory and its application to columns under axial loads. Slenderness ratio and its impact on column buckling. **Activities** Design projects on analyzing deflection of beams in various support configurations. Case studies on buckling failures and design improvements in structures. Problem-solving exercises on calculating beam deflection and critical buckling load. Presentations by students on different types of beam supports and their impact on deflection.	11-12

7	**Failure Theories and Applications** Introduction to failure theories for predicting material behavior under combined loading. Von Mises criterion and Tresca criterion for ductile and brittle materials, respectively. Applications of failure theories in design of machine components subjected	13

Contemporary Issues and Industrial Relevance

Strength of materials remains a critical field in engineering due to its role in addressing contemporary issues and maintaining industrial relevance.

Recommended Reading/Text

1. Mechanics of Materials by Ferdinand P. Beer and E. Russell Johnston Jr.
2. Mechanics of Materials by R.C. Hibbeler.
3. Strength of Materials by Andrew Pytel and Ferdinand P. Beer.
4. Advanced Mechanics of Materials by Arthur P. Boresi and Richard J. Schmidt.
5. Mechanics of Materials for Dummies by James B. Riggs and Marlow Ediger.
6. Online resources like National Committee for Fluid Mechanics Films
7. Software tools for fluid mechanics simulations (optional)

BOWEN UNIVERSITY, IWO
Faculty of Engineering
Department of Electrical/Electronic Engineering

Course Number: EEE 301 **Course Title:** Engineering Mathematics III
Semester: First **Credit Hours**: 3 hours
Contact Hours: Lecture- Three hours lecture (once per Week)
Location: Alma Rohm **Lecturer(s)**: Dr. A. O. Onokwai

Textbooks and other materials

1. *Francis Scheid*. Schaum's Outline of Theory and Problems of Numerical Analysis. Second Edition, Mcgraw-Hill. 1989.
2. *Jaan Kiusalaas*. Numerical Methods In Engineering With Matlab. Cambridge University Press, 2005.
3. *John Bird.* Engineering Mathematics. Sixth Edition. Elsevier Ltd., 2010.
4. *Rao V. Dukkipati*. Numerical Methods. New Age International (P) Limited, Publishers, 2010.
5. *Faires & Burden*. Numerical Methods. Third Edition. Brooks Cole, Third Edition, 2002.
6. *Stroud K. A., & Booth J. D*. Advanced Engineering Mathematics. Fourth Edition. Palgrave Macmillan, 2003.

a) **Course Overview and description**
Linear Algebra. Tensor algebra and analysis, Elements of Matrices, Determinants, Inverses of Matrices, bases representation of tensors. The Euclidean point space and vector spaces. Theory of Linear Equations. Eigen Values and Eigen Vectors. Analytical Geometry. Basic transformations: identity, spherical, Projection and Coordinate Transformation as tensors, Traces, Determinants, and other scalar invariants. Equivalent stresses and strains as examples of scalar invariant. Applications to design, analyses, and optimization. Elgenvalues, Eigenvectors of tensors. Solid Geometry. Polar, cylindrical, and spherical coordinates. Elements of functions of several variables. Surface Variables. Ordinary Integrals. Evaluation of Double Integrals, Triple Integrals, Line Integrals and Surface Integrals. Derivation and Integrals of Vectors. The gradient of scalar and fiels. Flux of Vectors. The curl of a vector field, Gauss, Greens and Stoke's theorems and applications: Determinations and applications to field equations in linear abd nonlinear mechanics. Singular Valued Functions. Multivalued Functions. Analytical Functions. Cauchy Riemann's Equations. Singularities and Zeroes. Contour Integration including the use of Cauchy's Integral Theorems. Bilinear transformation.

b) **Pre-requisites:** Nil

c) **Role in curriculum:** Core

d) **Course Learning Outcome (CLO) and Programme Outcomes (PO)**

Course Learning Outcomes: At the end of the course, the students should be able to:	**Suitable Bloom Taxonomy Relevant to the CLOs**	**POs**	**Assessment Tools**
Demonstrate a clear understanding of the course content, that is, possess a breadth of knowledge in the area covered;	2, 3, 4	1, 4	Homework, quizzes and Exams
Demonstrate an in-depth knowledge upon which a solid foundation can be built to demonstrate a depth of understanding in advanced mathematical topics;	2, 3	1, 2, 5	Homework, quizzes and Exams
Apply simple algorithms and use computational proficiency;	2, 4	1, 2, 3	Homework, quizzes and Exams
Define simple proofs for theorems and their applications; and	1, 2	1, 3	Homework, quizzes and Exams
Describe the acquired mathematical knowledge effectively in speech, writing and collaborative groups.	2, 3	2, 4	Homework, quizzes and Exams

e) Mapping of CLO to POs

Course Learning Outcomes	Programme Outcomes (POs):											
	1	2	3	4	5	6	7	8	9	10	11	12
Demonstrate a clear understanding of the course content, that is, possess a breadth of knowledge in the area covered;	3			3								
Demonstrate an in-depth knowledge upon which a solid foundation can be built to demonstrate a depth of understanding in advanced mathematical topics;	3	3			3							
Apply simple algorithms and use computational proficiency;	3	3	3									
Define simple proofs for theorems and their applications; and	3		3									
Describe the acquired mathematical knowledge effectively in speech, writing and collaborative groups.		3		3								

Keys: 1 = Slightly related, 2 = Moderately related, 3= Highly related

f) Expectations of Students

a. Attend three (2) hours of lectures per week.
b. Turn in problem set assignments and term papers as deemed fit by the instructors.
c. Complete a three (3) hour comprehensive final examination at the end of the semester.

g) Methods of Lecture Delivery/Teaching Aids

Lecture Delivery Methods

Lecturing/Teaching Method
Educator-Student Interaction (Discussion method)
Tutorial Method

Teaching Aids

Visual Aids (Use of PowerPoint slides, Lecture templates-handouts)

h) Course Content or Outline

Topics	Weeks
• Linear Algebra. Tensor algebra and analysis, Elements of Matrices, Determinants, Inverses of Matrices, bases representation of tensors. • The Euclidean point space and vector spaces. Theory of Linear Equations. Eigen Values and Eigen Vectors.	1 - 2

• Theory of Linear Equations. Eigen Values and Eigen Vectors. • Analytical Geometry. Basic transformations: identity, spherical, Projection and Coordinate Transformation as tensors, Traces, Determinants, and other scalar invariants.	3 - 4
• Equivalent stresses and strains as examples of scalar invariant. Applications to design, analyses, and optimization. • Eigenvalues, Eigenvectors of tensors. Solid Geometry. Polar, cylindrical, and spherical coordinates.	5 - 6
• Elements of functions of several variables. Surface Variables. • Ordinary Integrals. Evaluation of Double Integrals, Triple Integrals, Line Integrals and Surface Integrals.	7 - 8
• Derivation and Integrals of Vectors. The gradient of scalar and fiels. Flux of Vectors. • The curl of a vector field, Gauss, Greens and Stoke's theorems and applications: Determinations and applications to field equations in linear and nonlinear mechanics.	9 - 10
• Singular Valued Functions. Multivalued Functions. Analytical Functions. • Cauchy Riemann's Equations. Singularities and Zeroes. • Contour Integration including the use of Cauchy's Integral Theorems. Bilinear transformation.	11- 12
Lecture free week	13
Revision & Examination	14 -15

i) Method of Grading Continuous Assessment

Continuous Assessment (Assignments): 15%
Continuous Assessment Test: 15%
End of Semester Examination : 70%

j) Term Paper and Assignments

Assignments/Students Activities will be 60% dependent on the discovery made, questions arising from class discussion and during lectures.

k) Contemporary Issues and Industrial Relevance

Very relevant in facilitating efficient engineering design and analysis of energy systems, and also providing a basis for further study and research in energy conversion systems.

BOWEN UNIVERSITY, IWO
Faculty of Engineering
Department of Electrical/Electronic Engineering

Course Number: EEE 302
Course Title: Engineering Mathematics IV
Semester: Second
Credit Hours: 45 hours
Contact Hours: Lecture – Three hours of lectures per Week
Location: New Horizon
Lecturer(s): Engr Ogundoyin, S.O. & Dr A.O. Onokwai

Textbooks and other Materials:

1. *Erwin, Kreyszig* (2011) Advanced Engineering Mathematics, Tenth Edition, Wiley & Sons, Inc.
2. *Glyn, James et al.* (2011) Advanced Engineering Mathematics, Fourth Edition, Prentice Hall, Pearson.

a) Course Overview and description

This Engineering Mathematics course equips you with advanced techniques to solve complex engineering problems. Explore series solutions for differential equations, analyze eigenvalues, and delve into methods for solving partial differential equations. You'll also learn numerical techniques like interpolation and Runge-Kutta methods to tackle problems without exact analytical solutions.

b) Pre-requisites: EEE 301

c) Co-requisite(s): Nil

d) Role in Curriculum: Core

e) Course Learning Outcome (CLO) and Programme Outcomes (PO)

Course Learning Outcomes: upon successful completion of the course, students will be able to:	**Suitable Bloom Taxonomy Relevant to the CLOs**	**POs**	**Assessment Tools**
Understand the series solution of second-order linear differential equations with variable coefficients.	2, 3	1	Assignments, quizzes and Exams
Solve Bessel and Legendre equations, Sturn-Louville boundary value problems, and solutions of equations in two and three dimensions by separation of variables.	3, 4	1, 3	Assignments, quizzes and Exams
Demonstrate the use of operations in the solution of partial differential equations and linear integral equations.	1, 2, 3	1, 3	Assignments, quizzes and Exams
Explain and apply finite differences, interpolation formulae, finite difference equations, Runge-Kutta and other methods in solving ODEs and PDEs.	2, 3	1, 5	Assignments, quizzes and Exams
Apply these principles and techniques in the analysis and solution of practical engineering problems.	2, 3	1, 3	Assignments, quizzes and Exams

f) Mapping of CLOs to relevant POs

Course Learning Outcomes	Programme Outcomes (POs):											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Understand the series solution of second-order linear differential equations with variable coefficients.	3											
Solve Bessel and Legendre equations, Sturn-Louville boundary value problems, and solutions of equations in two and three dimensions by separation of variables.	3		3									
Demonstrate the use of operations in the solution of partial differential equations and linear integral equations.	3		3									
Explain and apply finite differences, interpolation formulae, finite difference equations, Runge-Kutta and other methods in solving ODEs and PDEs.	3				2							
Apply these principles and techniques in the analysis and solution of practical engineering problems.	3		3									

Keys: 1 = Slightly related, 2 = Moderately related, 3= Highly related

g) Expectations of Students

a. Attend 3 hours of lectures per week

b. Turn in assignments and projects as considered suitable by the tutors

c. Complete continuous assessment which involves mid-semester test

d. Complete a 3-hour comprehensive final examination at the end of the semester.

h) Methods of Lecture Delivery/Teaching Aids

Lecture Delivery Methods

Educator-Student Interaction (Discussion method)

Teaching Aids

Visual Aids (Use of PowerPoint slides, Lecture templates-handouts)

i) Course Content or Outline

Topics	Weeks
Ordinary Differential Equations (ODEs) • Series Solutions of Second-Order Linear ODEs with Variable Coefficients: Frobenius method for finding series solutions. • Bessel and Legendre Equations: Properties, solutions, and applications in engineering (e.g., heat transfer, wave propagation). • Equations with Variable Coefficients: Solving techniques using undetermined coefficients, and variation of parameters.	1-2
Boundary Value Problems • Sturm-Liouville Boundary Value Problems: Eigenvalues and eigenfunctions, orthogonality conditions, applications. • Separation of Variables for Partial Differential Equations (PDEs): Solving heat equation, wave equation, and Laplace equation using separation of variables.	3-4
Eigenvalue Problems • Definition, properties of eigenvalues and eigenvectors, solving eigenvalue problems for matrices. • Applications of Eigenvalue Problems: Normal modes of vibration, stability analysis of systems.	5
Operational Methods for Solving Differential Equations • Use of Operations in Solving PDEs: Laplace transform method for solving linear PDEs with initial and boundary conditions. • Linear Integral Equations: Fredholm and Volterra integral equations, methods of solution (e.g., method of iteration).	6 - 7
Integral Transforms • Fourier Transforms: Fourier series, Fourier transform definition, properties, applications in solving ODEs and PDEs. • Laplace Transforms: Definition, properties, and applications in solving ODEs with initial and boundary conditions. • Introduction to Other Transforms: Brief overview of Mellin and Hankel transforms.	8 - 9
Numerical Methods • Convolution Integrals and Hilbert Transforms: Definition, properties, and applications (optional). • Calculus of Finite Differences: Forward, backward, central difference approximations for derivatives. • Interpolation Formulae: Linear interpolation, Lagrange interpolation, applications in numerical analysis. • Finite Difference Equations: Methods for solving ordinary and partial differential equations numerically. • Runge-Kutta Methods: Numerical solution of ordinary differential equations. • Numerical Integration and Differentiation: Numerical techniques for approximating integrals and derivatives.	10 -12

Lecture free week	13
Revision & Examination	14 - 15

j) Method of Grading Continuous Assessment

Continuous Assessment (Assignment): 10%

Continuous Assessment Test 2 (Term paper): 20%

End of Semester Examination: 70%

k) Tutorials

Tutorial will be offered at the end of each module.

l) Term Paper and Assignments

This term paper challenges you to apply advanced techniques (series solutions, eigenvalue analysis) to solve a real-world engineering problem. Weekly assignments will solidify your understanding through calculations, exploring methods like Runge-Kutta, and solving differential equations. This course equips you to tackle complex engineering challenges mathematically.

m) Contemporary Issues and Industrial Relevance

Mastering these techniques is crucial for analyzing complex phenomena in various engineering fields. From modelling heat transfer to simulating mechanical vibrations, your knowledge is vital for industries like aerospace, energy, and material science. These powerful mathematical tools are essential for tackling cutting-edge engineering challenges.

BOWEN UNIVERSITY, IWO
Faculty of Engineering
Department of Electrical/Electronic Engineering

Course Code: EEE 303 **Course Title:** Electric Circuit Theory I
Semester: First **Credit Hours**: 2 hours
Contact Hours: Lecture - Two hours of lectures per Week
Location: New Horizon **Lecturer(s)**: Dr. S. I. Ojo
Textbooks and other Materials:

1. Electrical Circuit Theory and Technology 4th Edition by *John Bird*
2. Fundamentals of Electric Circuits by *Charles K. Alexander and Matthew Sadiku*

a) Course Overview and Description

This course explores network graph theory for analyzing complex circuits using mesh, nodal, loop, and cutset methods. It then dives into transient and AC/DC circuit analysis, two-port network parameters, and symmetrical components for unbalanced three-phase systems. Finally, students learn to utilize computer-aided circuit analysis software to simulate and analyze electrical circuits.

b) Pre-requisites: EEE 201

c) Co-requisite(s): Nil

d) Role in Curriculum: Core

e) Course Learning Outcome (CLO) and Programme Outcomes (PO)

Course Learning Outcomes: upon successful completion of the course, students will be able to:	**Suitable Bloom Taxonomy Relevant to the CLOs**	**POs**	**Assessment Tools**
Utilize network graph theory and methods like mesh, nodal, loop, and cutset analysis to solve complex linear network problems.	1, 2, 3	2, 3	Assignment, quizzes and Exams
Understand the transient behavior (natural and forced response) of circuits, analyze circuits with AC and DC sources, and employ various parameter sets (Z, Y, h, and t) to analyze two-port networks.	2, 3	1, 2	Assignment, quizzes and Exams
Utilize symmetrical components to analyze unbalanced three-phase power systems, including the analysis of symmetrical faults.	1, 2, 3	2, 3	Assignment, quizzes and Exams
Apply computer-aided circuit analysis software (like SPICE) to effectively simulate and analyze electrical circuits.	1, 2, 3	4	Assignment, quizzes and Exams

f) Mapping of CLOs to relevant POs

Course Learning Outcomes	**Programme Outcomes (POs):**											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Utilize network graph theory and methods like mesh, nodal, loop, and cutset analysis to solve complex linear network problems.		**3**	**2**									
Understand the transient behavior (natural and forced response) of circuits, analyze circuits with AC and DC sources, and employ various parameter sets (Z, Y, h, and t) to analyze two-port networks.	**3**	**2**										
Utilize symmetrical components to analyze unbalanced three-phase power systems, including the analysis of symmetrical faults.		**3**	**2**									
Apply computer-aided circuit analysis software (like SPICE) to effectively simulate and analyze electrical circuits.				**3**								

Keys: 1 = slightly related, 2 = moderately related, 3 = highly related

g) Expectations of Students

a. Attend 2 hours of lectures per week

b. Turn in assignments considered suitable by the tutors

c. Complete continuous assessment which involves mid-semester test

d. Complete a $2^{1}/_{2}$-hour comprehensive final examination at the end of the semester.

h) Methods of Lecture Delivery/Teaching Aids

Lecture Delivery Methods

Educator-Student Interaction (Discussion method and analogies)

Teaching Aids

Visual Aids (Use of Power Point slides, Lecture templates-handouts)

i) Course Content or Outline

Topics	Weeks
Network graph theory and its applications to network theorems: • Review of Network Theorems (Equivalence theorem, Thevenin's Theorem, Norton's Theorem and Superposition Theorem) • Maximum Power Transfer • Solution of Network problems • Node Voltage Equations • Loop Current Equations	1-3
Transient Circuit Analysis • Transients in RC and RL Circuits • Source free circuit • General case of finding capacitor voltage • Application of Laplace transform to RLC circuit	4 – 6
Analysis of two port networks • Open circuit Impedance Parameter (z Parameter) • Admittance Parameter (y Parameter) • Hybrid Parameters (h parameters) • Transmission Line parameters (ABCD Parameters)	7 - 9
Unbalanced three-phase networks: • Star and Delta network • Use of symmetrical components in solving unbalance three phase networks • Analysis of symmetrical faults	10 – 11
Computer aided circuit analysis: • Use of MATLAB in solving circuit analysis	12
Lecture free week	13
Revision & Examination	14 - 15

j) Method of Grading Continuous Assessment

Continuous Assessment (Assignment): 10%

Continuous Assessment Test: 15%

End of Semester Examination: 70%

k) Tutorials

Tutorial will be offered at the end of each module.

l) Term Paper and Assignments

The term paper will explore the application of network graph theory in analyzing linear networks through node, mesh, loop, and cutset analysis, while also examining transient circuit analysis techniques such as natural and forced responses for circuits with AC and DC sources, as well as the analysis of two-port networks using parameters like z, y, h, and t. Additionally, assignments will involve utilizing symmetrical components to solve unbalanced three-phase networks, including the analysis of symmetrical faults, and conducting exercises in computer-aided circuit analysis software to simulate and analyze electrical circuits.

m) Contemporary Issues and Industrial Relevance

Understanding network graph theory and its applications in analyzing linear networks is crucial in contemporary electrical engineering due to its relevance in designing efficient communication networks and power distribution systems. Additionally, proficiency in transient circuit analysis, including the analysis of two-port networks and the use of symmetrical components for solving unbalanced three-phase networks, is essential for addressing modern challenges in power system stability and reliability.

BOWEN UNIVERSITY, IWO
Faculty of Engineering
Department of Electrical/Electronic Engineering

Course Number: EEE 304
Course Title: Electric Circuit Theory II
Semester: Second
Credit Hours: 2
Contact Hours: Lecture - Two hours of lectures per Week
Location: New Horizon
Lecturer(s): Prof. O. A. Komolafe
Textbooks and other Materials:

a) Course Overview and description

This course explores advanced network analysis and design techniques. Students learn the synthesis of electrical networks, focusing on 2-element and 2-port networks. The course analyzes network behaviour using concepts like poles, zeros, and frequency response. It covers mathematical tools like positive real rational functions, partial and continued fraction expansions, and Foster and Cauer forms for network synthesis. Additionally, it introduces computer-aided design tools for network analysis and optimization.

b) Pre-requisites: EEE 303

c) Co-requisite(s): Nil

d) Role in Curriculum: Core

e) Course Learning Outcome (CLO) and Programme Outcomes (PO)

Course Learning Outcomes: upon successful completion of the course, students will be able to:	**Suitable Bloom Taxonomy Relevant to the CLOs**	**POs**	**Assessment Tools**
Analyze the frequency response of electrical networks using poles, zeros, and network functions.	3, 4	1	Assignments, quizzes and Exams
Apply the properties of positive real rational functions to network synthesis.	3, 4	1, 3	Assignments, quizzes and Exams
Solve partial and continued fraction expansions of network functions.	1, 2, 3	1	Assignments, quizzes and Exams
Analyze and synthesize 2-port networks using Foster and Cauer forms.	4, 5	1, 3	Assignments, quizzes and Exams
Use computer-aided design tools for network analysis and synthesis.	2, 3	1, 5	Assignments, quizzes and Exams

f) Mapping of CLOs to relevant POs

Course Learning Outcomes	**Programme Outcomes (POs):**											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Analyze the frequency response of electrical networks using poles, zeros, and network functions.	**3**											
Apply the properties of positive real rational functions to network synthesis.	**3**		**3**									
Solve partial and continued fraction expansions of network functions.	**3**											
Analyze and synthesize 2-port networks using Foster and Cauer forms.	**3**			**3**								
Use computer-aided design tools for network analysis and synthesis.	**3**		**3**									
Analyze the frequency response of electrical networks using poles, zeros, and network functions.	**3**				**2**							

Keys: 1 = Slightly related, 2 = Moderately related, 3= Highly related

g) Expectations of Students

a. Attend 2 hours of lectures per week

b. Turn in assignments and projects as considered suitable by the tutors

c. Complete continuous assessment which involves mid-semester test

d. Complete a 2-hour comprehensive final examination at the end of the semester.

h) Methods of Lecture Delivery/Teaching Aids

Lecture Delivery Methods

Educator-Student Interaction (Discussion method)

Teaching Aids

Visual Aids (Use of PowerPoint slides, Lecture templates-handouts)

i) Course Content or Outline

Topics	Weeks
Basic Concepts of Network Synthesis and Positive Real Functions • Introduction to network synthesis: designing networks with desired characteristics. • Synthesis of one-port networks using LC and RC elements. • Poles, zeros, and their relationship to the frequency response of networks. • General properties of positive real rational functions and their significance in network synthesis. • Partial and continued fraction expansion of positive real functions. • Foster and Cauer forms as realizations of positive real functions.	1-2
Synthesis of 2-Port Networks • Cauer reactance theorem and its application in 2-port network synthesis. • Constant resistance ladders and their design using Foster and Cauer forms. • Synthesis of networks with prescribed impedance or admittance functions.	3-4
Network Analysis Techniques • Hilbert transforms and their application in network analysis. • Relationships between the real and imaginary parts of analytic functions. • Applications of these relationships in network synthesis and analysis. • Frequency response analysis of networks: Bode plots, Nyquist plots, and group delay. • Network stability analysis using Nyquist criterion and other methods. • Transient response of networks and its analysis using Laplace transforms. • Synthesis of networks with specified magnitude and phase response. • Network transformations and their use in synthesis. • Applications of network synthesis in filter design and other areas.	5-7
Introduction to Active Networks and CAD of Networks • Introduction to active network elements: amplifiers, operational amplifiers, and gyrators. • Synthesis of active networks using passive and active elements. • Applications of active networks in signal processing and control systems. • Overview of CAD tools for network analysis and synthesis. • Simulation software for analyzing network behaviour and performance.	8-10

• Optimization techniques for designing networks with specific requirements.	
Case Studies and Applications • Practical examples of network synthesis in filter design, impedance matching, and other applications. • Analysis of real-world networks using CAD tools and simulation techniques. • Design projects using network synthesis principles.	11
Emerging Trends in Network Analysis and Synthesis • Introduction to modern network analysis methods: graph theory and matrix analysis. • Applications of network analysis in communication systems and power Electronic. • Future trends in network synthesis and design using advanced algorithms and materials.	12
Lecture free week	13
Revision & Examination	14 - 15

j) Method of Grading Continuous Assessment

Continuous Assessment (Assignments): 15%

Continuous Assessment (Test): 15%

End of Semester Examination: 70%

k) Tutorials

Tutorials are taken at the end of each module.

l) Term Paper and Assignments

Students will complete a term paper focusing on a specific network analysis and synthesis technique. This paper will involve researching, analyzing, and presenting findings on a chosen topic, demonstrating understanding and application of the learned concepts. Regular assignments throughout the course will reinforce theoretical knowledge and practical skills. These assignments will cover network analysis, synthesis, and the use of computer-aided design tools, providing opportunities for independent problem-solving and application of learned principles.

m) Contemporary Issues and Industrial Relevance

This course bridges the gap between theoretical network analysis and synthesis and their critical role in solving contemporary industrial challenges. Students will explore how these techniques are used in fields like telecommunications, signal processing, and control systems. The course addresses crucial issues such as miniaturization, energy efficiency, and the growing complexity of modern networks, demonstrating how network analysis and synthesis are fundamental in developing innovative solutions for these evolving needs.

BOWEN UNIVERSITY, IWO
Faculty of Engineering
Department of Electrical/Electronic Engineering

Course Number: EEE 305
Course Title: Electronic Engineering I
Semester: First
Credit Hours: 2 hours
Contact Hours: Lecture - Two hours of lectures per Week
Location: Alma Rohm
Lecturer(s): Engr Ogundoyin, S.O.
Textbooks and other Materials:

1. Microelectronic Circuits, Sedra, et al. (Eds.), Oxford University Press.

a) Course Overview and description

This Electronic Engineering course delves into the fundamentals of transistors (BJTs and FETs), exploring their biasing, analysis, and behaviour in amplifier circuits. Students will gain expertise in designing and analyzing various amplifier configurations for different functionalities, including power amplifiers and multivibrators.

b) Pre-requisites: Nil

c) Co-requisite(s): Nil

d) Role in Curriculum: Core

e) Course Learning Outcome (CLO) and Programme Outcomes (PO)

Course Learning Outcomes: upon successful completion of the course, students will be able to:	**Suitable Bloom Taxonomy Relevant to the CLOs**	**POs**	**Assessment Tools**
Explain the fundamentals of BJTs, their types, and configuration.	2, 3	1, 2	Assignments, quizzes and Exams
Understand the different kinds of bias and their effects on BJT circuits.	2, 3	1, 3	Assignments, quizzes and Exams
Analyze simple BJT circuits, including the operation point, the bias stability, and the thermal stability.	3, 4	1, 3	Assignments, quizzes and Exams
Discuss the principles behind the common emitter configuration, emitter follower, and cascading transistor amplifiers.	2, 4	1, 3	Assignments, quizzes and Exams
Apply Miller's Theorem and its dual to transistor amplifiers.	2, 3	1, 5	Assignments, quizzes and Exams
Analyze the field effect transistor, the MOSFET, the JFET, and the Y-parameter model.	1, 4	1, 3	Assignments, quizzes and Exams
Analyze amplifiers and power transistors and amplifiers, including distortion, frequency response, step response, and RC coupled amplifier.	4	1, 3, 5	Assignments, quizzes and Exams
Apply the concepts of transistor switches, transistor monostable and astable multi-vibrators, switching speed improvements, and solid-state multi-vibrators to designs.	2, 3	1, 3	Assignments, quizzes and Exams

f) Mapping of CLOs to relevant POs

Course Learning Outcomes	**Programme Outcomes (POs):**											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Explain the fundamentals of BJTs, their types, and configuration.	**3**	**3**										
Understand the different kinds of bias and their effects on BJT circuits.	**3**		**3**									
Analyze simple BJT circuits, including the operation point, the bias stability, and the thermal stability.	**3**		**3**									
Discuss the principles behind the common emitter configuration, emitter follower, and cascading transistor amplifiers.	**3**		**3**									
Apply Miller's Theorem and its dual to transistor amplifiers.	**3**				**2**							
Analyze the field effect transistor, the MOSFET, the JFET, and the Y-parameter model.	**3**		**3**									
Analyze amplifiers and power transistors and amplifiers, including distortion, frequency response, step response, and RC coupled amplifier.	**3**		**3**		**1**							
Apply the concepts of transistor switches, transistor monostable and astable multi-vibrators, switching speed improvements, and solid-state multi-vibrators to designs.	**3**		**2**									

Keys: 1 = Slightly related, 2 = Moderately related, 3= Highly related

g) Expectations of Students

a. Attend 2 hours of lectures per week

b. Turn in assignments and projects as considered suitable by the tutors

c. Complete continuous assessment which involves mid-semester test

d. Complete a 2-hour comprehensive final examination at the end of the semester.

h) Methods of Lecture Delivery/Teaching Aids

Lecture Delivery Methods

Educator-Student Interaction (Discussion method)

Teaching Aids

Visual Aids (Use of PowerPoint slides, Lecture templates-handouts)

i) Course Content or Outline

Topics	Weeks
Bipolar Junction Transistors (BJTs) • Introduction to BJTs: Structure, operation principles, current components. • BJT Configurations (Common Emitter - CE, Common Base - CB, Common Collector - CC). • Biasing Techniques: Fixed Bias, Emitter Bias, Bias Stability, Thermal Stability (analysis and design). • Graphical Analysis of CE Configuration: Input and Output Characteristics, DC Operating Point. • BJT Hybrid Model: Introduction, derivation of parameters. • Amplifier Analysis using Hybrid Model: Gain calculations (voltage, current), input and output resistances. • Emitter Follower Circuit: Design and analysis. • Cascading Transistor Amplifiers: Gain, impedance considerations (Miller's Theorem).	1-3
Field-Effect Transistors (FETs) and JFETs • Introduction to FETs: Types (JFET, MOSFET), characteristics compared to BJTs. • JFET Biasing techniques (similar to BJTs). • Small-Signal Model of JFETs: Analysis for amplifier design. • High-Frequency Model and Hybrid-Π Model for JFETs: Understanding behaviour at higher frequencies. • Single-Stage CE Amplifier Analysis using JFET Model. • Y-Parameter Model for JFETs: Analysis and design considerations.	4 - 6
Classification and Analysis of Amplifiers • Amplifier Classification: Classes A, B, AB, C (characteristics, efficiency). • Distortion in Amplifiers: Harmonic distortion, intermodulation distortion, methods for minimization. • Frequency Response of Amplifiers: Bandwidth limitations, gain-bandwidth product. • Step Response of Amplifiers: Transient behavior analysis. • RC Coupled Amplifiers: Design and frequency response analysis with an emitter bypass capacitor. • Cascaded Amplifier Stages: Frequency response considerations. • Noise in Amplifiers: Types, minimization techniques.	7-9
Power Transistors and Power Amplifiers • Power Transistors: Characteristics, heat dissipation considerations. • Darlington Connection: Combining BJTs for increased current gain. • NPN-PNP Power Amplifier Stages: Push-pull design for improved efficiency. • Tuned Amplifiers: Design for specific frequency bands.	10-11

Transistor Switches and Multivibrators • Transistor as a Switch: ON and OFF states, switching characteristics. • Monostable and Astable Multivibrators using Transistors: Design and applications. • Techniques for Improving Switching Speed: Reducing rise and fall times. • Introduction to Solid-State Multivibrators: Different circuit configurations.	12
Lecture free week	13
Revision & Examination	14 - 15

j) Method of Grading Continuous Assessment

Continuous Assessment (Assignment): 10%
Continuous Assessment Test: 20%
End of Semester Examination: 70%

k) Tutorials

Tutorial will be offered at the end of each module.

l) Term Paper and Assignments

This course equips you to analyze real-world electronic circuits using BJTs, FETs, and amplifiers. Weekly assignments solidify your grasp of concepts through calculations and problem-solving. A term paper challenges you to apply this knowledge to design solutions for a chosen electronic device. Explore simulations or build your own circuit to bridge theory and practice.

m) Contemporary Issues and Industrial Relevance

This BJT and FET fundamentals course stays relevant by addressing challenges like miniaturization and new materials. Understanding these devices is crucial in today's industries, from designing efficient power Electronic to building core components for wireless communication and integrated circuits.

BOWEN UNIVERSITY, IWO
Faculty of Engineering
Department of Electrical/Electronic Engineering

Course Number: EEE 306
Course Title: Electronic Engineering II
Semester: Second
Credit Hours: 2
Contact Hours: Lecture - Two hours of lectures per Week
Location: MICOM LAB II
Lecturer(s): Dr A. S. Oluwole
Textbooks and other Materials:

a) Course Overview and description

This course handles the design and application of operational amplifiers (Op-Amps). Students will explore the ideal Op-Amp model and its characteristics, followed by building and analyzing basic Op-Amp circuits for various applications. You will learn about the internal workings of Op-Amps, including the input stage, bias currents, offset voltage, and factors affecting performance like power supply rejection, common-mode rejection, and frequency response. Additionally, students will learn about techniques for compensating for errors and stabilizing Op-Amp circuits. Finally, the course covers advanced topics like active filters using biquadratic transfer functions, voltage regulators with emitter-follower and feedback configurations, and nonlinear circuit applications like comparators, Schmitt triggers, and analogue multipliers.

b) Pre-requisites: EEE 305

c) Co-requisite(s): Nil

d) Role in Curriculum: Core

e) Course Learning Outcome (CLO) and Programme Outcomes (PO)

Course Learning Outcomes: upon successful completion of the course, students will be able to:	**Suitable Bloom Taxonomy Relevant to the CLOs**	**POs**	**Assessment Tools**
Analyze and design operational amplifier circuits for various applications, including inverting/non-inverting amplifiers, integrators, differentiators, and filters.	1, 2, 4	i, iii	Assignments, quizzes and Exams
Understand the principles of active filters, including biquadratic transfer functions, standard filter responses, and design techniques like Sallen-Key networks.	1, 2	1	Assignments, quizzes and Exams
Design and implement voltage regulators using operational amplifiers and transistors, considering factors like current limiting and over-voltage protection.	2, 5	1, 3	Assignments, quizzes and Exams
Analyze and design oscillators using various topologies, including square-wave, triangle-wave, and sawtooth generators.	4, 5	1, 3	Assignments, quizzes and Exams
Apply operational amplifiers in nonlinear circuit applications such as comparators, Schmitt triggers, rectifiers, peak detectors, and analog multipliers.	1, 2, 3	1, 5	Assignments, quizzes and Exams

f) Mapping of CLOs to relevant POs

Course Learning Outcomes	Programme Outcomes (POs):											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Analyze and design operational amplifier circuits for various applications, including inverting/non-inverting amplifiers, integrators, differentiators, and filters.	**3**		**3**									
Understand the principles of active filters, including biquadratic transfer functions, standard filter responses, and design techniques like Sallen-Key networks.	**3**											
Design and implement voltage regulators using operational amplifiers and transistors, considering factors like current limiting and over-voltage protection.	**3**		**3**									
Analyze and design oscillators using various topologies, including square-wave, triangle-wave, and sawtooth generators.	**3**		**3**									
Apply operational amplifiers in nonlinear circuit applications such as comparators, Schmitt triggers, rectifiers, peak detectors, and analog multipliers.	**3**		**3**		**2**							

Keys: 1 = Slightly related, 2 = Moderately related, 3= Highly related

g) Expectations of Students

a. Attend 2 hours of lectures per week

b. Turn in assignments and projects as considered suitable by the tutors

c. Complete continuous assessment which involves mid-semester test

d. Complete a 2-hour comprehensive final examination at the end of the semester.

h) Methods of Lecture Delivery/Teaching Aids

Lecture Delivery Methods

Educator-Student Interaction (Discussion method and analogies)

Teaching Aids

Visual Aids (Use of PowerPoint slides, Lecture templates-handouts)

i) Course Content or Outline

Topics	Weeks
Review and Introduction to Op-Amps • Recap of ideal Op-Amp characteristics and basic Op-Amp circuits. • Differential and common-mode operation of Op-Amps. • Applications of Op-Amps in inverting and non-inverting amplifiers, voltage followers, and summers/differentiators.	1
Op-Amp: Input stage, Performance, Specifications, and Compensation • Analysis of the Op-Amp input stage: differential amplifier configuration. • Input bias current, offset current, and their effects on circuit accuracy. • Input offset voltage and its impact on circuit performance. • Voltage drift and its impact on Op-Amp stability over time. • Power supply rejection ratio (PSRR) and common-mode rejection ratio (CMRR). • Offset error compensation techniques: nulling and auto-zeroing. • Frequency response of Op-Amps: gain-bandwidth product and its implications. • Open-loop and closed-loop frequency response analysis.	2-3
Transient Response and Stability of Op-Amps • Transient response of Op-Amps: slew rate and its limitations. • Op-Amp stability considerations: phase shift and feedback. • Gain and phase margins and their importance for stable operation. • Frequency compensation techniques to improve Op-Amp stability.	4
Active Filters, Sallen-Key Filter Networks and Advanced Filter Design • Analysis and design of Sallen-Key filter networks using Op-Amps. • Frequency and impedance scaling techniques for filter design. • Gain adjustments in active filters and their implementation. • Frequency transformations in filter design: high-pass to low-pass and vice versa	5-6
State-Variable Filters and High-Order Filters • State-variable filter configurations and their advantages. • Design of high-order filters using state-variable techniques. • Comparison of different filter design methods and their applications.	7
Voltage Regulators, Power Supplies, Oscillators and Signal Generation • Principles of oscillation and the Barkhausen Criterion. • Design and analysis of various oscillator types: phase-shift, Wien-bridge, Hartley, and Colpitts oscillators. • Square-wave, triangle-wave, and sawtooth waveform generators using Op-Amps.	9

Nonlinear Circuit Applications of Op-Amps and Advanced Applications of Op-Amps • Comparators and their applications in zero-crossing detectors, pulse generators, and level shifters. • Schmitt triggers and their use in level detectors and pulse shaping circuits. • Precision rectifiers, peak detectors, and log/antilog amplifiers using Op-Amps. • Analogue multipliers and their applications in modulation and signal processing. • Instrumentation amplifiers and their use in high-precision measurements. • Integrators and differentiators using Op-Amps and their applications in signal processing. • Logarithmic and exponential amplifiers using Op-Amps. • Analog-to-digital and digital-to-analog converters using Op-Amps.	10-11
Computer-Aided Design (CAD) of Electronic Circuits • Introduction to CAD tools for electronic circuit analysis and design. • Simulation software for analyzing Op-Amp circuits, filters, and other applications. • Optimization techniques for designing circuits with specific requirements.	12
Lecture free week	13
Revision & Examination	14 - 15

j) Method of Grading Continuous Assessment

Continuous Assessment (Assignment): 15%
Continuous Assessment (Test): 15%
End of Semester Examination: 70%

k) Tutorials

Tutorials are taken at the end of each module.

l) Term Paper and Assignments

This course lets students complete a term paper focused on a specific operational amplifier application or design technique. This paper will involve researching, analyzing, and presenting findings on a chosen topic, demonstrating understanding and application of the learned concepts. Regular assignments throughout the course will reinforce theoretical knowledge and practical skills. These assignments will cover operational amplifier circuit analysis, design, and simulation, providing opportunities for independent problem-solving and application of learned principles.

m) Contemporary Issues and Industrial Relevance

This course examines the critical role of operational amplifiers in contemporary engineering. Students will explore how these versatile devices are used in various industries, including signal processing, control systems, and medical instrumentation. The course addresses crucial issues like miniaturization, energy efficiency, and the increasing need for precise signal manipulation. By mastering op-amp design and applications, students gain the skills to contribute to the development of innovative solutions for the ever-evolving technological landscape.

BOWEN UNIVERSITY, IWO
Faculty of Engineering
Department of Electrical/Electronic Engineering

Course Code: EEE 307 **Course Title:** Electromagnetic Fields and Waves I
Semester: First **Credit Hours**: 3 hours
Contact Hours: Lecture - Three hours lectures per Week
Location: Alma Rohm **Lecturer(s)**: Dr. D. O. Akande
Textbooks and other Materials:

William H. Hayt Jr, and John A. Buck, (2012), Engineering Electromagnetics, 8th edition, McGraw-Hill Companies, Inc

a) Course Overview and description

This course delves into the mathematical tools (vector calculus) needed to understand electromagnetism. It explores Maxwell's equations, the foundation for electromagnetics, and analyze wave behavior in various contexts like waveguides and cavity resonators.

b) Pre-requisites: Nil

c) Co-requisite(s): Nil

d) Role in Curriculum: Core

e) Course Learning Outcome (CLO) and Programme Outcomes (PO)

Course Learning Outcomes: upon successful completion of the course, students will be able to:	**Suitable Bloom Taxonomy Relevant to the CLOs**	**POs**	**Assessment Tools**
Understand the fundamental mathematical tools such as vector analysis, calculus and integra theorems.	2, 4, 5	1	Assignment, quizzes and Exams
Understand the fundamental laws governing electric and magnetic fields.	2, 3, 4	1, 2	Assignment, quizzes and Exams
Apply the concept of Maxwell's Equations and their role in unifying electromagnetic fields and waves.	2, 3	1, 2	Assignment, quizzes and Exams
Compare the behavior of wave propagation mechanism in different media and their effect.	2, 3, 4	2, 4	Assignment, quizzes and Exams
Analyze the principles of electromagnetic wave propagation in waveguides and cavity resonance.	2, 4	2, 4	Assignment, quizzes and Exams
Justify the concept of microwave application.	2, 6	1, 9, 11	Assignment, quizzes and Exams

f) Mapping of CLOs to relevant POs

Course Learning Outcomes	Programme Outcomes (POs):											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Understand the fundamental mathematical tools such as vector analysis, calculus and integra theorems.	**3**											
Understand the fundamental laws governing electric and magnetic fields.	**3**	**3**										
Apply the concept of Maxwell's Equations and their role in unifying electromagnetic fields and waves.	**3**	**2**										
Compare the behavior of wave propagation mechanism in different media and their effect.		**3**		**3**								
Analyze the principles of electromagnetic wave propagation in waveguides and cavity resonance.		**3**		**2**								
Justify the concept of microwave application.	**3**								**2**		**1**	

Keys: 1 = Slightly related, 2 = Moderately related, 3 = Highly related

g) Expectations of Students

a. Attend 3 hours of lectures per week
b. Turn in assignments and projects as considered suitable by the tutors
c. Complete continuous assessment which involves mid-semester test
d. Complete a 3-hour comprehensive final examination at the end of the semester.

h) Methods of Lecture Delivery/Teaching Aids

Lecture Delivery Methods

Educator-Student Interaction (Discussion method and analogies)

Teaching Aids

Visual Aids (Use of PowerPoint slides, Lecture templates-handouts)

12) **Course Content or Outline**

Topics	**Weeks**
Review of Vector Calculus: • Vector Algebra – Scalar and vector products (dot product, cross product), vector properties (magnitude, direction). • Coordinate Systems – Cartesian, cylindrical, spherical coordinates – conversion and applications in electromagnetism. • Differential Calculus – Gradient, divergence, curl and their physical interpretations. Integral Theorems – Introduction to Gauss's law, Stokes' theorem, Green's theorem.	1 – 3
Integral Theorems and Electrostatic Fields • Integral Theorems – In-depth exploration of Gauss's law for electrostatics, applications in electric field calculations. • Electrostatic Fields – Application of Gauss's law to solve problems involving electric fields and charge distributions.	4 – 5
Time-Varying Fields and Maxwell's Equations • Faraday's Law – Explanation of Faraday's Law of electromagnetic induction and its implications. • Ampere's Law and Maxwell's Equations – Limitations of Ampere's Law, introduction of Maxwell's equations as a complete description of electromagnetism, Lorentz force law.	6 – 7
Wave Propagation and Poynting's Theorem • Uniform Plane Waves – Wave equation, propagation characteristics of uniform plane waves in free space. • Time-Harmonic Fields and Poynting's Theorem – Concepts of time-harmonic fields, wave polarization (linear, circular, elliptical). Introduction to Poynting's theorem and its applications.	8 – 9
Waves in Media and Boundary Conditions • Waves in Media – Material properties (permittivity, permeability) and their impact on wave propagation. • Boundary Conditions and Wave Interactions – Reflection and refraction of electromagnetic waves at plane interfaces, boundary conditions for various materials.	10 – 11
Principles and Applications of Waveguides and Cavity Resonators • Waveguides – Properties of waves in rectangular waveguides, modes of propagation, plane and group velocities, wave impedance. • Cavity Resonators – Principles of cavity resonators, field distributions, applications in microwave engineering.	12
Lecture free week	13
Revision & Examination	14 - 15

j) Method of Grading Continuous Assessment

Continuous Assessment (Assignment): 10%

Continuous Assessment Test: 20%

End of Semester Examination: 70%

k) Tutorials

Tutorial will be offered at the end of each module.

l) Term Paper and Assignments

· This term paper challenges you to delve into the fascinating world of electromagnetism. Analyze real-world scenarios and propose solutions using the acquired knowledge of electromagnetic principles. The course also includes assignments designed to solidify your understanding through calculations, problem-solving exercises, and potentially, simulations or experiments involving electromagnetic phenomena.

m) Contemporary Issues and Industrial Relevance

This course equips you with the mathematical foundation and electromagnetism principles crucial for understanding and developing advanced technologies like microwave devices and communication systems. By mastering these concepts, the knowledge and tools sought after in the engineering industry is obtained.

BOWEN UNIVERSITY, IWO
Faculty of Engineering
Department of Electrical/Electronic Engineering

Course Number: EEE 308 **Course Title:** Electromagnetic Fields and Waves II
Semester: Second **Credit Hours**: 3 hours
Contact Hours: Lecture - Three hours of lectures per Week
Location: Alma Rohm **Lecturer(s)**: Dr. J. O. Abolade
Textbooks and other Materials:

1. Engineering Electromagnetics 6th Ed. by *Hayt, W. H. and Buck, J. A.*
2. Riad, Sedki M., and Iman M. Salama. 2020. Electromagnetic Fields and Waves: Fundamentals of Engineering. 1st ed. New York: McGraw-Hill Education.

a) Course Overview and description

This course explores how signals travel on long wires (transmission lines), including matching techniques and impedance transformers. It then covers waveguides, including propagation, attenuation, and termination. Finally, it touches on antennas and radio wave propagation at different frequencies, along with power line communication.

b) Pre-requisites: Nil

c) Co-requisite(s): Nil

d) Role in Curriculum: Core

e) Course Learning Outcome (CLO) and Programme Outcomes (PO)

Course Learning Outcomes: upon successful completion of the course, students will be able to:	**Suitable Bloom Taxonomy Relevant to the CLOs**	**POs**	**Assessment Tools**
Explain the transmission line as an element in a circuit, name its parameters, and use Smith chart to solve transmission line problems;	2, 3	1, 2, 5	Homework, quizzes and Exams
Categorize various types of transmission lines and waveguides, their performance, characteristics, and practical applications	2, 4	1, 2, 3	Homework, quizzes and Exams
Differentiate general electromagnetic wave propagation phenomena in different media and apply the boundary conditions for electric and magnetic fields at different interfaces	2, 4	1, 2	Homework, quizzes and Exams
Interpret the theory of antennas and radiating elements	2, 6	1, 2	Homework, quizzes and Exams
Apply the concept of communication using power line.	3	1	Homework, quizzes and Exams

f) Mapping of CLOs to relevant POs

Course Learning Outcomes	**Programme Outcomes (POs):**											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Explain the transmission line as an element in a circuit, name its parameters, and use Smith chart to solve transmission line problems;	**3**	**3**			**2**							
Categorize various types of transmission lines and waveguides, their performance, characteristics, and practical applications	**3**	**3**	**2**									
Differentiate general electromagnetic wave propagation phenomena in different media and apply the boundary conditions for electric and magnetic fields at different interfaces	**3**	**2**										
Interpret the theory of antennas and radiating elements	**3**	**3**										
Apply the concept of communication using power line.	**3**											

Keys: 1 = Slightly related, 2 = Moderately related, 3= Highly related

g) Expectations of Students

a. Attend 3 hours of lectures per week
b. Turn in assignments and projects as considered suitable by the tutors
c. Complete continuous assessment which involves mid-semester test
d. Complete a 3-hour comprehensive final examination at the end of the semester.

h) Methods of Lecture Delivery/Teaching Aids

Lecture Delivery Methods

Educator-Student Interaction (Discussion method) Video Tutorials Electrical systems

Teaching Aids

Visual Aids (Use of PowerPoint slides)

i) Course Content or Outline

Review of transmission line theory. Use of Smith chart, single and double-stub matching on lines; quarter wave line as an impedance transformer. Propagation in common waveguides. Attenuation in guides. Guide termination, Antennae. Introduction to radio wave propagation in the medium: high, very high and ultra-high frequency bands. Communication on power lines.

Topics	Weeks
Introduction to Transmission Lines • Fundamentals of transmission lines (distributed elements vs. lumped elements) • Characteristic impedance (Z_0) and its dependence on material properties and geometry • Introduction to wave propagation on transmission lines • Voltage and current relationships on transmission lines	1 - 2
Transmission Line Analysis • Reflection coefficient and its significance • Voltage Standing Wave Ratio (VSWR) and its measurement • Smith Chart introduction and its use for impedance calculations • Transmission line analysis using Smith Chart (reflection coefficient, impedance matching)	3-4
Matching Techniques and Impedance Transformation • Single and double-stub matching techniques for impedance transformation • Design considerations and limitations of stub matching • Quarter-wave transformer theory and applications • Impedance matching for optimal power transfer	5-6
Waveguides and Propagation • Introduction to waveguides (rectangular, circular, etc.) and their operating principles • Different waveguide modes (TE and TM) and their characteristics • Cutoff frequency and its impact on waveguide operation • Attenuation mechanisms in waveguides (ohmic and dielectric losses)	7-8
Waveguide Termination and Antennas • Importance of proper waveguide termination and matching techniques • Design considerations for waveguide terminators • Introduction to antenna theory - principles of radiation and reception • Different antenna types (dipole, Yagi, etc.) and their radiation patterns	9-10
Radio Wave Propagation and Power Line Communication • Introduction to radio wave propagation and its dependence on frequency • Characteristics of High Frequency (HF), Very High Frequency (VHF), and Ultra-High Frequency (UHF) bands • Applications of radio waves in communication systems • Power Line Communication (PLC) concept and its potential benefits • Challenges and limitations of PLC technology	11-12
Lecture free week	13
Revision & Examination	14 - 15

j) Method of Grading Continuous Assessment

Continuous Assessment (Assignment): 10%

Continuous Assessment Test: 20%
End of Semester Examination: 70%

k) Tutorials

Tutorial will be offered at the end of each module.

l) Term Paper and Assignments

· Assignments were given at the end of each lectures.

m) Contemporary Issues and Industrial Relevance

Miniaturizing communication component comes with the issue of signal integrity and losses. More so, emerging technologies like millimeter-wave and satellite constellation require specialized antennas for efficient signal transmission and reception. The understanding gained from this course can be found useful in Designing communication systems, optimizing antenna design, Radio Spectrum Management, and smart grid Technologies.

BOWEN UNIVERSITY, IWO
Faculty of Engineering
Department of Electrical/Electronic Engineering

Course Number: EEE 309 **Course Title:** Electrical Machine I
Semester: First **Credit Hours**: 2 hours
Contact Hours: Lecture - Two hours lectures per Week.
Location: **Lecturer(s)**: Dr. S. L Gbadamosi
Textbooks and other Materials:
[1*] J..B.Gupta* Theory and Performance of Electrical Machines
[2] *I.J Nagrath & D.P Kothari,* Electrical Machines, McGraw Hill Education (India) pvt. Ltd. 4th Ed.

a) Course Overview and description

This course provides an overview of fundamental principles in electrical engineering, focusing on relays, actuators, and the transformation of electric energy. Students will study transformer performance, including efficiency, regulation, and types such as auto transformers and instrument transformers. The course covers electromechanical energy conversion principles, particularly in direct current (DC) machines, exploring armature windings, torque, excitation methods, and characteristics of DC generators and motors. Additionally, students will learn about motor and generator selection, speed control, electric braking, and the operation of cross-field and commutator machines. Through theoretical learning and practical applications, students will develop a strong foundation for electrical engineering practice.

b) Pre-requisites: Nil

c) Co-requisite(s): Nil

d) Role in Curriculum: Core

e) Course Learning Outcome (CLO) and Programme Outcomes (PO)

Course Learning Outcomes: upon successful completion of the course, students will be able to:	**Suitable Bloom Taxonomy Relevant to the CLOs**	**POs**	**Assessment Tools**
Explain the principles of electromechanical energy conversion, focusing on the transformation of electrical energy into mechanical energy.	2, 3	1	Homework, quizzes and Exams
Describe the construction and operation of direct current (DC) machines, including armature windings, excitation methods, and armature reaction effects.	2, 4	1, 3, 4, 10	Homework, quizzes and Exams
Evaluate the characteristics of DC generators and motors, including their speed control, electric braking, and practical applications.	2, 6	5	Homework, quizzes and Exams
Apply basic principles for selecting appropriate motors and generators for specific practical applications, considering factors such as efficiency, torque, and speed requirements.	1, 3	5	Homework, quizzes and Exams
Explain the transformation of electric energy in transformers, including transformer performance metrics such as efficiency, regulation, and per unit values.	2, 3	2	Homework, quizzes and Exams
Analyze the equivalent circuits of transformers and their impact on transformer efficiency and regulation.	1, 2, 4	2, 5, 7, 11	Homework, quizzes and Exams

f) Mapping of CLOs to relevant POs

Course Learning Outcomes	Programme Outcomes (POs):											
	1	2	3	4	5	6	7	8	9	10	11	12
Explain the principles of electromechanical energy conversion, focusing on the transformation of electrical energy into mechanical energy.	**3**											
Describe the construction and operation of direct current (DC) machines, including armature windings, excitation methods, and armature reaction effects.	**2**	**3**			**2**					**2**		
Evaluate the characteristics of DC generators and motors, including their speed control, electric braking, and practical applications.					**3**							
Apply basic principles for selecting appropriate motors and generators for specific practical applications, considering factors such as efficiency, torque, and speed requirements.					**3**							
Explain the transformation of electric energy in transformers, including transformer performance metrics such as efficiency, regulation, and per unit values.		**3**										
Analyze the equivalent circuits of transformers and their impact on transformer efficiency and regulation.		**3**			**2**		**3**				**2**	

Keys: 1 = Slightly related, 2 = Moderately related, 3= Highly related

g) Expectations of Students

a. Attend 2 hours of lectures per week

b. Turn in assignments and projects as considered suitable by the tutors

c. Complete continuous assessment which involves mid-semester test

d. Complete a 2-hour comprehensive final examination at the end of the semester.

h) Methods of Lecture Delivery/Teaching Aids

Lecture Delivery Methods

Educator-Student Interaction (Discussion method) Video Tutorials Electrical systems

Teaching Aids

Visual Aids (Use of PowerPoint slides, Lecture templates-handouts)

i) Course Content or Outline

Topics	Weeks
Electromechanical Energy conversion, forces and torque in magnetic field systems – energy balance, energy and force in a singly excited magnetic field system, determination of magnetic force, co-energy, multi excited magnetic field systems. DC Generators – Principle of operation, Action of commutator, constructional features, armature windings, lap and wave windings, simplex and multiplex windings, use of laminated armature, E. M.F. Equation. Methods of Excitation: separately excited and self-excited generators, buildup of E.M.F., critical field resistance and critical speed, causes for failure to self-excite and remedial measures, Armature reaction: Cross magnetizing and demagnetizing AT/pole, compensating winding, commutation, reactance voltage, methods of improving commutation. Load characteristics of shunt, series and compound generators, parallel operation of DC generators, use of equalizer bar and cross connection of field windings, load sharing.	1 - 4
DC Motors: Principle of operation, Back E.M.F., Torque equation, characteristics and application of shunt, series and compound motors, Armature reaction and commutation, Starting of DC motor, Principle of operation of 3 point and 4-point starters, drum controller, Constant & Variable losses, calculation of efficiency, condition for maximum efficiency. Speed control of DC Motors: Armature voltage and field flux control methods, Ward Leonard method. Methods of Testing: direct, indirect and regenerative testing, brake test, Swinburne's test, Load test, Hopkinson's test, Field's test, Retardation test, separation of stray losses in a DC motor test.	5 - 6
Transformers: Single phase transformer, Constructional details, Core, windings, Insulation, principle of operation, emf equation, magnetising current and core losses, no load and on load operation, Phasor diagram, equivalent circuit, losses and efficiency, condition for maximum efficiency, voltage regulation, approximate expression for voltage regulation, open circuit and short circuit tests, Sumpner's test, Inrush of switching currents, harmonics in single phase transformers, magnetizing current wave form, Parallel operation of transformers.	7 - 9
Three phase Transformer: Constructional features of three phase transformers – three phase connection of transformers (Dd0, Dd6, Yy0, Yy6, Dy1, Dy11, Yd1, Yd11, zigzag), Scott connection, open delta connection, three phase to six phase connection, oscillating neutral, tertiary winding, three winding transformer, equal and unequal turns ratio, parallel operation, load sharing. Distribution transformers, all day efficiency, Autotransformers, saving of copper, applications, tap- changing transformers, cooling of transformers.	10 - 12
Lecture free week	13

Revision & Examination	14 - 15

j) Method of Grading Continuous Assessment

Continuous Assessment (Assignment): 10%

Continuous Assessment Test: 20%

End of Semester Examination: 70%

k) Tutorials

Tutorial will be offered at the end of each module.

l) Term Paper and Assignments

Assignments and other project work will be offered after each module.

m) Contemporary Issues and Industrial Relevance

- Relays and Actuators: In today's industrial landscape, the demand for automation and smart systems is rapidly increasing. Relays and actuators play a crucial role in these systems, enabling efficient control and operation of various industrial processes. The integration of advanced sensors and communication technologies with relays and actuators enhances system reliability, flexibility, and responsiveness.
- Transformation of Electric Energy: With the growing emphasis on renewable energy sources and distributed generation, the efficient transformation and distribution of electric energy are paramount. Advances in transformer design and smart grid technologies facilitate the integration of renewable energy sources, grid stability, and load management.
- Electromechanical Energy Conversion: The transition towards electrification in various sectors, including transportation and industrial processes, highlights the importance of efficient electromechanical energy conversion. Emerging technologies, such as high-efficiency motors and generators, are essential for reducing energy consumption and greenhouse gas emissions.
- Motor and Generator Selection: Selecting the appropriate motor and generator for specific applications requires consideration of factors such as power requirements, environmental conditions, and cost-effectiveness. Integrating advanced control algorithms and predictive maintenance techniques optimizes equipment performance and reduces operational costs.
- Speed Control and Electric Braking: In industrial automation and transportation systems, precise speed control and efficient braking mechanisms are essential for safety and productivity. Advancements in variable frequency drives (VFDs) and regenerative braking technologies improve system efficiency and reduce energy consumption.

BOWEN UNIVERSITY, IWO
Faculty of Engineering
Department of Electrical/Electronic Engineering

Course Number: EEE 310 **Course Title:** Electrical Machine II
Semester: Second **Credit Hours**: 2 hours
Contact Hours: Lecture - Two hours lectures per Week.
Location: Alma Rohr **Lecturer(s)**: Dr. S. L Gbadamosi
Textbooks and other Materials:
[1] *J.B.Gupta* Theory and Performance of Electrical Machines
[2] *I.J Nagrath & D.P Kothari*, Electrical Machines, McGraw Hill Education (India) pvt. Ltd. 4th Ed.

a) Course Overview and description

This course provides a comprehensive overview of electric machines commonly used in electrical engineering. Topics include synchronous machines, induction machines, and single-phase machines. Students will learn about the principles, construction, characteristics, and applications of each type of machine. Additionally, starting methods, speed control techniques, and operational considerations will be covered. Through theoretical study and practical applications, students will develop a solid understanding of electric machine operation and their roles in various engineering contexts.

b) Pre-requisites: EEE 309

c) Co-requisite(s): Nil

d) Role in Curriculum: Core

e) Course Learning Outcome (CLO) and Programme Outcomes (PO)

Course Learning Outcomes: upon successful completion of the course, students will be able to:	**Suitable Bloom Taxonomy Relevant to the CLOs**	**POs**	**Assessment Tools**
Describe the construction and operating principles of induction machines, including three-phase squirrel cage rotor and wound rotor configurations.	2, 5	1, 2, 3, 5, 11	Homework, quizzes and Exams
Evaluate various starting methods and speed control techniques for three-phase induction machines, and their suitability for different applications.	4, 6	3, 5	Homework, quizzes and Exams
Analyze the torque-slip relationship, power flow, losses, and efficiency of induction machines, considering factors such as rotor construction and operating conditions.	4, 6	2, 5, 10, 11	Homework, quizzes and Exams
Understand the principles of operation of synchronous machines, including the generation of rotating magnetic fields, electromotive force (e.m.f) equations, and characteristics of three-phase alternators.	2, 3, 4	1	Homework, quizzes and Exams
Analyze the winding factors and equivalent circuits of synchronous machines, distinguishing between salient-pole and cylindrical rotor configurations and their respective applications.	3, 4	2	Homework, quizzes and Exams
Evaluate the characteristic features of salient-pole and cylindrical rotor synchronous machines, including their performance under different operating conditions.	4, 6	2	Homework, quizzes and Exams

f) Mapping of CLOs to relevant POs

Course Learning Outcomes	**Programme Outcomes (POs):**											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Describe the construction and operating principles of induction machines, including three-phase squirrel cage rotor and wound rotor configurations.	**3**	**3**	**2**		**2**						**2**	
Evaluate various starting methods and speed control techniques for three-phase induction machines, and their suitability for different applications.			**2**		**3**							
Analyze the torque-slip relationship, power flow, losses, and efficiency of induction machines, considering factors such as rotor construction and operating conditions.		**2**			**3**					**2**	**2**	
Understand the principles of operation of synchronous machines, including the generation of rotating magnetic fields, electromotive force (e.m.f) equations, and characteristics of three-phase alternators.	**3**											
Analyze the winding factors and equivalent circuits of synchronous machines, distinguishing between salient-pole and cylindrical rotor configurations and their respective applications.		**2**										
Evaluate the characteristic features of salient-pole and cylindrical rotor synchronous machines, including their performance under different operating conditions.		**2**										

Keys: 1 = Slightly related, 2 = Moderately related, 3= Highly related

g) Expectations of Students

a. Attend 2 hours of lectures per week

b. Turn in assignments and projects as considered suitable by the tutors.

c. Complete continuous assessment which involves mid-semester test

d. Complete a 2-hour comprehensive final examination at the end of the semester.

h) Methods of Lecture Delivery/Teaching Aids

Lecture Delivery Methods

Educator-Student Interaction (Discussion method) Video Tutorials Electrical systems

Teaching Aids

Visual Aids (Use of PowerPoint slides, Lecture templates-handouts)

i) Course Content or Outline

Topics	Weeks
SINGLE PHASE & SPECIAL PURPOSE MOTORS: Single phase induction motor – Constructional Features-Double revolving field theory Equivalent circuit - split-phase motors - Capacitor start Capacitor run motors. Principles of A.C. Series Motor-Universal motor, Reluctance motor, Hysteresis motor, Stepper motor, Brushless DC motor and AC motor, Shaded pole motor	1 - 2
POLYPHASE INDUCTION MOTORS: Construction details of cage and wound rotor machines- production of a rotating magnetic field – principle of operation – rotor emf and rotor frequency – rotor reactance, rotor current and Power factor at standstill and during operation. Rotor power input, rotor copper loss and mechanical power developed and their inter relation-torque equation – expressions for maximum torque and starting torque – torque slip and speed characteristics – equivalent circuit – phasor diagram.	3 - 5
INDUCTION MOTORS: TESTING, STARTING & SPEED CONTROL METHODS: No load and blocked rotor tests-predetermination of performance-methods of starting and starting current and torque calculations. Speed control methods: change of voltage, change of frequency, change of poles and methods of consequent poles; cascade connection. Injection of an emf into rotor circuit.	6 - 7
SYNCHRONOUS MACHINES: Constructional Features of round rotor and salient pole machines – Armature windings – Integral slot and fractional slot windings; Distributed and concentrated windings – distribution, pitch and winding factors –emf Equation. Armature reaction - leakage reactance – synchronous reactance and impedance – experimental determination - phasor diagram – load characteristics. Regulation by synchronous impedance method, M.M.F. method, Z.P.F. method.	8 - 9
PARALLEL OPERATION OF SYNCHRONOUS MACHINES: Synchronizing alternators with infinite bus bars – synchronizing power torque – parallel operation and load sharing - Effect of change of excitation and mechanical power input. **SYNCHRONOUS MOTORS:** Theory of operation – phasor diagram – Variation of current and power factor with excitation – synchronous condenser – Mathematical analysis for power developed. hunting and its suppression– Methods of starting.	10 - 12
Lecture free week	13
Revision & Examination	14 - 15

j) Method of Grading Continuous Assessment

Continuous Assessment (Assignment): 10%
Continuous Assessment Test: 20%
End of Semester Examination: 70%

k) Tutorials

Tutorial will be offered at the end of each module.

l) Term Paper and Assignments

· Assignments and other project work will be offered after each module

m) Contemporary Issues and Industrial Relevance

The contemporary issues and industrial relevance of the course content on electric machines are significant in various sectors of modern engineering.

Single-Phase Machines

- Universal Motors and Applications: Universal motors find applications in a wide range of household and industrial appliances, offering high starting torque and variable speed control.
- Split-Phase and Capacitor-Start Motors: These motors are commonly used in applications where high starting torque and efficiency are required, such as air conditioners and compressors.
- Repulsion Motors and Shaded-Pole Motors: Repulsion motors and shaded-pole motors are utilized in specific applications, such as fans and pumps, where simple and reliable operation is essential.

Synchronous Machines

- Rotating Magnetic Fields: Understanding rotating magnetic fields is crucial for the design and operation of synchronous machines, which are commonly used in power generation and distribution systems.
- Characteristic Features of Rotors: Salient-pole and cylindrical rotors offer distinct advantages in different applications, such as power plants and industrial motors, where torque requirements vary.
- Applications: Synchronous machines play a critical role in power generation, providing stability and grid synchronization necessary for reliable electricity supply.

Induction Machines

- Rotor Construction and Characteristics: Understanding the construction and characteristics of induction machine rotors is essential for designing efficient motors and generators used in various industrial applications.
- Torque/Slip Relation: Knowledge of torque/slip relation enables engineers to optimize induction machine performance for specific applications, ensuring reliable operation and energy efficiency.
- Starting Methods and Speed Control: Effective starting methods and speed control techniques enhance the versatility and efficiency of induction machines, enabling precise control in industrial processes.

BOWEN UNIVERSITY, IWO
Faculty of Engineering
Department of Electrical/Electronic Engineering

Course Number: EEE 311

Course Title: Electrical/Electronic Laboratory and Mini-Project I

Semester: First

Credit Hours: 3 hours

Contact Hours: 3 hours of practical per Week

Location: Laboratory

Lecturer(s): All staff

Textbooks and other Materials:

- Lab Manual

a) Course Overview and Description

Laboratory experiments covering topics taught in Basic Electrical Machines I, Electronic Engineering I and Electric Circuit Theory.

b) Pre-requisites: Nil

c) Co-requisite(s): New

d) Role in Curriculum: Core

e) Course Learning Outcome (CLO) and Programme Outcomes (PO)

Course Learning Outcomes: upon successful completion of the course, students will be able to:	**Suitable Bloom Taxonomy Relevant to the CLOs**	**POs**	**Assessment Tools**
Understand the operating principles and characteristics of bipolar junction transistors (BJTs) and field-effect transistors (FETs), including their biasing techniques and small-signal models.	**2**	1, 5	Practical Reports
Analyze and design common-emitter and common-source amplifier configurations using graphical and small-signal models, considering parameters such as gain, input/output resistances, and frequency response.	**4, 5**	1, 2, 3, 6, 8, 11	Practical Reports
Demonstrate proficiency in analyzing power transistors and power amplifiers, including class A, B, AB, and C amplifier configurations, push-pull designs, and tuned amplifiers.	**3, 4, 5**	1, 4, 5	Practical Reports
Demonstrate proficiency in analyzing power transistors and power amplifiers, including class A, B, AB, and C amplifier configurations, push-pull designs, and tuned amplifiers.	**3, 4**	1, 4, 5	Practical Reports
Apply symmetrical components in the analysis of unbalanced three-phase networks, including the identification and mitigation of symmetrical faults.	**3, 4**	1, 4, 5	Practical Reports
Apply computer-aided circuit analysis tools to simulate and analyze electrical circuits, enhancing understanding and proficiency in circuit analysis techniques.	**3, 5, 6**	5, 10	Practical Reports

f) Mapping of CLOs to relevant POs

Course Learning Outcomes	Programme Outcomes (POs):											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Understand the operating principles and characteristics of bipolar junction transistors (BJTs) and field-effect transistors (FETs), including their biasing techniques and small-signal models.	**3**				**3**							
Analyze and design common-emitter and common-source amplifier configurations using graphical and small-signal models, considering parameters such as gain, input/output resistances, and frequency response.	**3**	**3**	**3**			**3**		**3**			**3**	
Demonstrate proficiency in analyzing power transistors and power amplifiers, including class A, B, AB, and C amplifier configurations, push-pull designs, and tuned amplifiers.	**3**			**3**	**3**							
Demonstrate proficiency in analyzing power transistors and power amplifiers, including class A, B, AB, and C amplifier configurations, push-pull designs, and tuned amplifiers.	**3**			**3**	**3**							
Apply symmetrical components in the analysis of unbalanced three-phase networks, including the identification and mitigation of symmetrical faults.	**3**			**3**	**3**							
Apply computer-aided circuit analysis tools to simulate and analyze electrical circuits, enhancing understanding and proficiency in circuit analysis techniques.					**3**					**3**		

Keys: 1 = Slightly related, 2 = Moderately related, 3= Highly related

g) Expectations of Students

a. Attend at least 11 practical sessions

b. Submit Practical Report after every practical

c. Design and implement one mini project

h) Methods of Lecture Delivery/Teaching Aids

Lecture Delivery Methods

Practical instruction in the lab by the technologist as supervised by the attending lecturer

Teaching Aids

Laboratory Equipment

i) Course Content or Outline

Topics	Weeks
Energy meter and watt meter & mesh analysis and its application	1
Nodal analysis and its application & superposition theorem	2
Steady state behavior of simple RLC circuit	3
Polarity test of a single-phase Transformer	4
Open circuit test on Single-Phase Transformer	5
Short circuit test on Transformer	6
Oscilloscope and Signal Generator	7
Operational amplifier characteristics	8
Transistor amplifier types	9
Study of characteristics of SCR, MOSFET, TRIAC and IGBT	10
Motor starting with DC Shunt Excitation	11
Motor starting with DC Compound Excitation	12
Motor starting with DC Series Excitation	13
Revision & Examination	14-15

j) Method of Grading Continuous Assessment

Practical Report submitted: 30%

One mini project submitted: 70%

k) Tutorials

- None

l) Term Paper and Assignments

One Mini Project design on a voltage regulation system using operational amplifiers and feedback control techniques

m) Contemporary Issues and Industrial Relevance

- Regulatory Compliance: Adhering to industry rules and laws requires a thorough understanding of the concepts of mesh analysis, nodal analysis, superposition theorem, and RLC circuit behaviour. Electrical systems must be checked by professionals to make sure they adhere to safety, dependability, and efficiency regulations.

- Motor Starting procedures: In industrial applications where motors are used frequently, it is crucial to understand the numerous motor starting procedures using distinct excitation methods (shunt, compound, and series). In industrial settings, dependable and efficient machinery performance is ensured by using proper motor starting techniques.

- Technological Advancements: For specialists in the area, staying up to date with the newest advancements in power Electronic components such as SCR, MOSFET, TRIAC, and IGBT is essential. Engineers may effectively develop and implement advanced electronic systems by having a thorough understanding of these systems' properties and applications.

BOWEN UNIVERSITY, IWO

Faculty of Engineering

Department of Electrical/Electronic Engineering

Course Number: EEE 312 **Course Title:** Digital Electronic

Semester: Second **Credit Hours**: 3 hours

Contact Hours: Lecture - Two lectures (One and Two hours) per Week

Location: Milcom Lab **Lecturer(s)**: Engr. Dr. Isaac A. Ojedokun

Textbooks and other Materials:

1. Thomas L. Floyd: "Digital Fundamentals"
2. John F. Wakerly: "Digital Design: Principles and Practices"
3. M. Morris Mano and Charles R. Kime: "Digital Logic and Computer Design"
4. Roger L. Tokheim: "Digital Electronic: Principles and Applications"

a) Course Overview and description

The fundamentals and uses of digital logic circuits are covered in the introductory course Digital Electronic Circuits. Number systems, logic gates, logic expressions, and the use of switches to realize them are all covered. The focus of the course is on applying techniques like Boolean algebra and simplification tools like Karnaugh maps to generate logic circuits from expressions and vice versa. It also includes the use of transistors to create logic gates, as well as different codes, counters, registers, and applications such as PLAs, RAM, ROM, encoders, multiplexers, and adders. An introduction to microprocessors, covering architecture, memory organization, and applications, may be mentioned to wraps off the course.

b) Pre-requisites: EEE 305

c) Co-requisite(s): Nil

d) Role in Curriculum: Core

e) Course Learning Outcome (CLO) and Programme Outcomes (PO)

Course Learning Outcomes: Upon successful completion of the course, students will be able to:	**Suitable Bloom Taxonomy Relevant to the CLOs**	**POs**	**Assessment Tools**
Utilizing logic gates and Boolean algebra, analyze and construct digital circuits;	2, 3	1, 2, 6	Homework, quizzes and Exams
Analyze sequential logic circuits to process and control data;	2, 3	1, 4, 5	Homework, quizzes and Exams
Generate and convert signals between digital and analog domains**;**	5, 6	1, 3, 4	Homework, quizzes and Exams
Demonstrate digital technology and components in practical ways; and	3, 4	5, 9	Homework, quizzes and Exams
Analyze and select digital components according to their electrical characteristics.	4, 5	1, 5	Homework, quizzes and Exams

f) Mapping of CLOs to relevant POs

Course Learning Outcomes	**Programme Outcomes (POs):**											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Utilizing logic gates and Boolean algebra, analyze and construct digital circuits;	**3**	**3**				**3**						
Analyze sequential logic circuits to process and control data;	**3**			**3**	**2**							
Generate and convert signals between digital and analog domains**;**	**3**	**2**		**2**								
Demonstrate digital technology and components in practical ways; and					**3**				**2**			

Analyze and select digital components according to their electrical characteristics.	**3**				**3**							

Keys: 1 = Slightly related, 2 = Moderately related, 3= Highly related

g) Expectations of Students

1. Attend 3 hours of lectures per week
2. Turn in assignments and projects as instructed by the tutors
3. Complete continuous assessment, which involves mid-semester test and others
4. Complete a 3-hour comprehensive final examination at the end of the semester.

h) Methods of Lecture Delivery/Teaching Aids

Lecture Delivery Methods

Educator-Student Interaction (Discussion method) Video Tutorials

Teaching Aids

Visual Aids (Use of PowerPoint slides, Lecture templates-handouts, Laboratory work)

i) Course Content or Outline

Topics	Weeks
Review of Boolean Algebra and Logic Circuits: Recap of Boolean algebra principles, Introduction to logic gates and their truth tables, Basics of digital logic circuits. **Number Systems and Logic Codes**: binary, decimal, and hexadecimal number systems, Introduction to logic codes such as BCD and Gray code and Conversion between different number systems and codes	1-2
Minimization of Boolean Functions: Principles of Boolean function minimization, Karnaugh maps (K-maps) and tabular methods for minimization, Examples and practice problems on function minimization, **Combinational Logic Systems**: Overview of different types of combinational logic systems, basic combinational logic elements: AND, OR, NOT gates, Design of adders, code converters, encoders, and decoders.	3-4
Programmable Logic Arrays (PLAs) and Error Detection: Introduction to programmable logic arrays (PLAs), Error detecting and correcting codes, including parity checkers, Implementation of error detection circuits. **Sequential Logic Systems:** Introduction to sequential logic systems, Study of flip-flops and their transition modes (clock, pulse), Design of synchronous sequential logic systems	5-6
Counters, Registers, and Sequence Generators: Design and implementation of counters and registers, Study of sequence generators and their applications, Practice exercises on counter and sequence generator design. **Logical Design using MSI, LSI, and VLSI:** Overview of MSI (Medium-Scale Integration) and LSI (Large-Scale Integration), Introduction to VLSI and ULSI (Very Large-Scale Integration and Ultra Large-Scale Integration), Case studies and examples of logical designs using MSI, LSI, VLSI, and ULSI, Comparison of MSI, LSI, and ULSI (Ultra Large-Scale Integration) technologies.	7-8
Memories and Their Realization: Introduction to different types of memories: ROM, PROM, EPROM, EEPROM, SRAM, DRAM, Study of magnetic memories: HDD, FDD, CDs, tapes, Realization of memory circuits and applications. **Logic Element Properties and Technologies:** Study of logic element properties: fan-out, fan-in, noise margin, propagation delay, switching speed. **Introduction to interfaces and converters:** Study of serial-parallel converters and their applications, Introduction to analog-to-digital (ADC) and digital-to-analog (DAC) converters, Implementation of sample and hold circuits, successive approximation ADC, R-2R ladder networks, Overview of TTL-MOS interfaces and their design considerations	9-10
Tutorials	11-12
Lecture free week	13
Revision & Examination	14 - 15

j) Method of Grading Continuous Assessment

Continuous Assessment (Assignment): 10%

Continuous Assessment Test: 20%

End of Semester Examination: 70%

k) Tutorials

Tutorials will be taken at the end of the modules.

l) Term Paper and Assignments

The term paper is given to students in groups and will examine Boolean algebra, logic circuits, number systems, and logic codes in detail. It will cover topics like error detection and correction codes, combinational and sequential logic systems, minimization techniques, memory types, and their implementations in different technologies. In order to design, analyze, and optimize logical systems using MSI, LSI, and VLSI technologies—as well as interfaces, converters, and memory components—the assignment include both problem-solving and practical exercises. These assignments are given to determine how well the students have been able to grasp the course.

m) Contemporary Issues and Industrial Relevance

Miniaturizations leading to new developments in integrated circuit technologies, including Very Large-Scale Integration (VLSI) and Ultra-Large-Scale Integration (ULSI), as well as issues with power consumption, noise reduction, and signal integrity in high-speed logic circuits are all included in this course's contemporary issues and industrial relevance. Furthermore, in contemporary electronic systems design, the use of mixed-signal interfaces and converters for smooth interaction between the digital and analogue domains offers substantial practical value.

BOWEN UNIVERSITY, IWO
Faculty of Engineering
Department of Electrical/Electronic Engineering

Course Code: EEE 313 **Course Title:** Engineering Acoustics
Semester: First **Credit Hours**: 2 hours
Contact Hours: Lecture - Two hours of lectures per Week
Location: Alma Rohm **Lecturer(s)**: Engr. Diarah. R. S
Textbooks and other Materials:

1. Acoustics: A Textbook for Engineers and Physicists by Jerry H. Ginsberg (Springer Science & Business Media, 2014)
2. Sound and Vibration by *R. Roy* (Elsevier, 2007)
3. Engineering Acoustics by *Malcolm J. Crocker* (Springer Science & Business Media, 1994)

a) Course Overview and description

This course explores the fascinating world of sound, delving into its physical principles, practical applications, and the technology behind capturing and reproducing audio.

b) Pre-requisites: Nil

c) Co-requisite(s): Nil

d) Role in Curriculum: Core

e) Course Learning Outcome (CLO) and Programme Outcomes (PO)

Course Learning Outcomes: upon successful completion of the course, students will be able to:	**Suitable Bloom Taxonomy Relevant to the CLOs**	**POs**	**Assessment Tools**
Understand the basic principles of sound waves and the properties of acoustic system	2, 3	1, 2	Homework, quizzes and Exams
Explain the working principles of different microphone types	2, 4	1, 2	Homework, quizzes and Exams
Demonstrate the concept of linear systems and natural modes in audio applications.	3, 4	1, 2	Homework, quizzes and Exams
Compare the properties and functionalities of loudspeakers.	2, 4	1, 2	Homework, quizzes and Exams
Describe the process of electroacoustic recording and reproduction.	2, 3	1, 2	Homework, quizzes and Exams
Assess the principles of ultrasonic systems, types properties and distribution pattern of acoustic transducers.	5, 6	1, 2	Homework, quizzes and Exams
Outline the properties of magnetic materials relevant to audio applications.	2, 3, 4	1, 3	Homework, quizzes and Exams

f) Mapping of CLOs to relevant POs

Course Learning Outcomes	**Programme Outcomes (POs):**											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Understand the basic principles of sound waves and the properties of acoustic system	**2**	**3**										
Explain the working principles of different microphone types	**2**	**3**										
Demonstrate the concept of linear systems and natural modes in audio applications.	**3**	**2**										
Compare the properties and functionalities of loudspeakers.	**3**	**2**										
Describe the process of electroacoustic recording and reproduction.	**3**		**3**									

Keys: 1 = Slightly related, 2 = Moderately related, 3= Highly related

g) Expectations of Students

a. Attend 2 hours of lectures per week

b. Turn in assignments and projects as considered suitable by the tutors

c. Complete continuous assessment which involves mid-semester test

d. Complete a 2-hour comprehensive final examination at the end of the semester.

h) Methods of Lecture Delivery/Teaching Aids

Lecture Delivery Methods

Educator-Student Interaction (Discussion method) Video Tutorials Electrical systems

Teaching Aids

Visual Aids (Use of PowerPoint slides, Lecture templates-handouts)

i) Course Content or Outline

Topics	Weeks
Fundamentals of Sound • Explain the nature of sound as a pressure wave. • Describe the process of sound propagation through different media. • Define and analyze the properties of sound waves: frequency, wavelength, and amplitude. • Introduce the concept of wave superposition and interference. • Explain the relationship between sound properties and human perception (pitch, loudness, timbre). • Discuss the human hearing range and limitations. • Simple acoustic systems (standing waves in pipes, resonance)	1 - 3
Acoustic Transducers • Explain the concept of acoustic transducers and their role in converting sound to electrical signals (microphones) and vice versa (loudspeakers). • Analyze the operation and characteristics of different microphone types (dynamic, condenser, etc.). • Discuss applications of microphones in various fields (recording, communication, etc.). • Describe the properties, types, and responses of loudspeakers (frequency response, directivity). • Analyze factors affecting sound quality from loudspeakers	4 - 6
Electroacoustics and Beyond • Define linear systems in the context of sound and explain their behavior. • Understand the concept of natural modes of vibration in acoustic systems. • Explain the basic principles of electroacoustic recording and reproduction (microphone-amplifier-loudspeaker system). • Discuss factors affecting signal fidelity and quality. • Understand the nature of ultrasonic sound (frequencies above human hearing range) and its applications (e.g., medical imaging, cleaning). • Describe the types of transducers used in ultrasonic systems	7 - 9
Magnetism and Recording • Explain the magnetic properties of materials relevant to audio applications (ferromagnetic, ferrimagnetic). • Discuss the role of hysteresis in magnetic recording. • Analyze the principles of magnetic circuits used in audio equipment. • Explain the importance of magnetic shielding for audio equipment. • Describe magnetic recording techniques, including tape recording (e.g., audio and video tapes). • Analyze the advantages and limitations of magnetic recording.	10 - 12
Lecture free week	13

Revision & Examination	14 - 15

j) Method of Grading Continuous Assessment

Continuous Assessment (Assignment): 10%

Continuous Assessment Test: 20%

End of Semester Examination: 70%

k) Tutorials

Tutorial will be offered at the end of each module.

l) Term Paper and Assignments

Homework, quizzes and mid semester Test would be conducted.

m) Contemporary Issues and Industrial Relevance

Acoustic engineering plays a vital role in our everyday lives, shaping how we experience sound in various environments. Here's a breakdown of how contemporary issues and industrial relevance intersect with acoustic engineering:

- **Contemporary Issues:**
  - Growing populations and urbanization lead to increased noise pollution in cities from traffic, construction, and industrial activities.
  - Health concerns associated with chronic exposure to noise, including hearing loss, sleep disturbance, and stress.
  - Balancing noise control measures with the need for economic development and infrastructure projects.
- **Industrial Relevance:**
  - Designing quieter transportation systems (electric vehicles, improved engine designs).
  - Developing advanced noise barriers and soundproofing materials for buildings.
  - Implementing urban planning strategies that promote noise reduction (green spaces, traffic flow management).

BOWEN UNIVERSITY, IWO
Faculty of Engineering
Department of Electrical/Electronic Engineering

Course Number: EEE 314

Course Title: Electrical/Electronic Laboratory and Mini-Project I

Semester: First

Credit Hours: 6 hours

Contact Hours: 6 hours of practical per Week

Location: Laboratories

Instructor(s): Supervising Lecturers and Lab Technologists

Textbooks and other Materials:

- Lab Manual

a) Course Overview and description

The course is structured in such a way to foster in-depth understanding of Electrical services and its relation to industries. Issues of Safety and Regulations of Electrical installations were given an in-depth consideration.

b) Pre-requisites: EEE 311

c) Co-requisite(s): New

d) Role in Curriculum: Compulsory

e) Course Learning Outcome (CLO) and Programme Outcomes (PO)

Course Learning Outcomes: upon successful completion of the course, students will be able to:	**Suitable Bloom Taxonomy Relevant to the CLOs**	**POs**	**Assessment Tools**
Understand the fundamental concepts of digital Electronic, including Boolean algebra, logic circuits, and combinational logic systems, through practical experimentation and hands-on activities.	2, 3, 4	1, 5, 10	Practical Reports
Demonstrate proficiency in the construction, operation, and analysis of basic electrical machines such as DC generators, DC motors, and transformers, through practical exercises and laboratory experiments.	3, 4	1, 2, 5, 9	Practical Reports
Apply knowledge of electromagnetic principles to design and analyze electromechanical energy conversion systems, including transformers and DC machines, through practical laboratory exercises and simulations.	3, 6	1, 4, 5, 9	Practical Reports
Demonstrate proficiency in troubleshooting and fault analysis techniques for digital and analog electronic circuits, utilizing tools and equipment commonly used in industry, to enhance problem-solving skills in practical engineering scenarios.	2, 3, 4	1, 4, 5, 9	Practical Reports
Evaluate the principles of voltage regulation to design and implement linear IC voltage regulators, including understanding basic emitter-follower configurations and current limiter circuits.	4, 6	1, 4, 5, 9	Practical Reports
Develop practical skills in circuit design, simulation, and prototyping using modern electronic design automation (EDA) tools, to prepare for professional practice in electronic engineering and related fields.	2, 5	1, 5, 9, 12	Practical Reports

f) Mapping of CLOs to relevant POs

Course Learning Outcomes	Programme Outcomes (POs):											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Understand the fundamental concepts of digital Electronic, including Boolean algebra, logic circuits, and combinational logic systems, through practical experimentation and hands-on activities.	**3**				**3**					**3**		
Demonstrate proficiency in the construction, operation, and analysis of basic electrical machines such as DC generators, DC motors, and transformers, through practical exercises and laboratory experiments.	**3**	**3**			**3**				**3**			
Apply knowledge of electromagnetic principles to design and analyze electromechanical energy conversion systems, including transformers and DC machines, through practical laboratory exercises and simulations.	**3**	**3**		**3**					**3**			
Demonstrate proficiency in troubleshooting and fault analysis techniques for digital and analog electronic circuits, utilizing tools and equipment commonly used in industry, to enhance problem-solving skills in practical engineering scenarios.	**3**	**3**		**3**					**3**			
Evaluate the principles of voltage regulation to design and implement linear IC voltage regulators, including understanding basic emitter-follower configurations and current limiter circuits.	**3**	**3**		**3**					**3**			
Develop practical skills in circuit design, simulation, and prototyping using modern electronic design automation (EDA) tools, to prepare for professional practice in electronic engineering and related fields.	**3**				**3**				**3**			**3**

Keys: 1 = Slightly related, 2 = Moderately related, 3= Highly related

g) Expectations of Students

a. Attend at least 11 practical sessions

b. Submit Practical Report after every practical

c. Design and implement one mini project

h) Methods of Lecture Delivery/Teaching Aids

Lecture Delivery Methods

Practical instruction in the lab by the technologist as supervised by the attending lecturer

Teaching Aids

Laboratory Equipment, Videos and Illustrations

i) Course Content or Outline

Topics	Weeks
Dc shunt generator	1
Controlling the speed of a DC Shunt Motor	2
Load characteristics & to plot torque speed characteristics of DC Series Motor.	3
The operating characteristics of Series and Shunt connected motors.	4
The critical field resistance of a separately excited DC generator	5
Terminals, determination of voltage transformation ratio of a single-phase transformer.	6
The voltage regulation of a single-phase transformer at different loads	7
Half adder and full adder circuits and verify the truth table using logic gates	8
Implementation of AND, NAND, OR, NOR, X-OR & X-NOR gates	9 - 10
The basic switching diode and to plot its characteristic curve.	11
The operation of the Zener diode and to plot its characteristic curve.	12
The operation of a basic common emitter biasing configuration for bipolar junction transistors	13
Revision & Examination	14-15

j) Method of Grading Continuous Assessment

Practical Report submitted: 70%

One mini project submitted: 30%

k) Tutorials

- None

l) Term Paper and Assignments

One Mini Project design on a voltage regulation system using operational amplifiers and feedback control techniques.

m) Contemporary Issues and Industrial Relevance

Contemporary Issues:

- The incorporation of renewable energy sources into power systems necessitates the use of effective digital control systems to maintain grid stability and variable power generation.
- Engineers with experience in digital Electronic are increasingly needed to develop and optimize electronic circuits for a range of applications due to advancements in semiconductor technology and miniaturization.
- Growing need for power Electronic and energy-efficient electrical equipment to meet legal requirements and ecological concerns.

Industrial Relevance:

- The design and implementation of contemporary control systems, automation, and digital signal processing—all utilized in industrial processes and consumer Electronic—require strong digital Electronic skills.
- For industries engaged in power generation, transmission, and distribution as well as in the production of electric vehicles and renewable energy systems, a working knowledge of electrical machinery and power Electronic is essential.
- To drive innovation and technological improvements in the telecommunications, semiconductor manufacturing, consumer Electronic, and aerospace industries, an expert in electronic engineering is a prerequisite.

BOWEN UNIVERSITY, IWO
Faculty of Engineering
Department of Electrical/Electronic Engineering

Course Number: EEE 315
Course Title: Signals and Systems Analysis
Semester: First
Credit Hours: 2 hours
Contact Hours: Lecture - Two hours of lectures per Week
Location: Alma Rohm
Lecturer(s): Engr Ogundoyin, S.O.
Textbooks and other Materials:

1. *LizheTan, and Jean, Jiang*, (2019) Digital Signal Processing: Fundamentals and Applications, Third Edition, Academic Press, Elsevier, Inc.
2. *Winser E. Alexander, and Cranos M. Williams* (2017) Digital Signal Processing: Principles, Algorithms and System Design, Academic Press, Elsevier, Inc.

a) Course Overview and description

This Signals and Systems Analysis course explores how we represent and analyze signals, both in time and frequency domains. You'll learn about Fourier series, transforms, convolution, and how to characterize different systems (linear, time-invariant, discrete-time). The course also covers sampling theory and essential tools like MATLAB and LabVIEW for signal-processing tasks.

b) Pre-requisites: Nil

c) Co-requisite(s): Nil

d) Role in Curriculum: Core

e) Course Learning Outcome (CLO) and Programme Outcomes (PO)

Course Learning Outcomes: upon successful completion of the course, students will be able to:	**Suitable Bloom Taxonomy Relevant to the CLOs**	**POs**	**Assessment Tools**
Understand complex numbers, vectors, and orthogonal functions and their applications in signal processing.	2, 3	1, 2	Assignments, quizzes and Exams
Categorize and analyze different types of signals in the time and frequency domains, including Fourier transforms and their applications in signal processing.	4, 5	1, 3, 5	Assignments, quizzes and Exams
Analyze and simulate different types of systems, including linear time-invariant systems, discrete-time systems, and frequency-domain systems using the Laplace transform.	4, 5, 6	1, 3, 5	Assignments, quizzes and Exams
Evaluate signals based on power and energy and using probability density functions and correlation functions for statistical analysis.	4, 6	1, 4	Assignments, quizzes and Exams
Understand Sampling theory, techniques, and constraints.	2, 3	1, 5	Assignments, quizzes and Exams
Apply computer software (MATLAB and LabVIEW) in signal processing, signal analysis, and simulations to solve real-world problems.	3, 5, 6	1, 5, 7	Assignments, quizzes and Exams

f) Mapping of CLOs to relevant POs

Course Learning Outcomes	**Programme Outcomes (POs):**											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Understand complex numbers, vectors, and orthogonal functions and their applications in signal processing.	**3**	**3**										
Categorize and analyze different types of signals in the time and frequency domains, including Fourier transforms and their applications in signal processing.	**3**		**3**		**2**							
Analyze and simulate different types of systems, including linear time-invariant systems, discrete-time systems, and frequency-domain systems using the Laplace transform.	**3**		**3**		**2**							
Evaluate signals based on power and energy and using probability density functions and correlation functions for statistical analysis.	**3**			**3**								
Understand Sampling theory, techniques, and constraints.	**3**				**3**							
Apply computer software (MATLAB and LabVIEW) in signal processing, signal analysis, and simulations to solve real-world problems.	**3**				**2**		**2**					

Keys: 1 = Slightly related, 2 = Moderately related, 3= Highly related

g) Expectations of Students

a. Attend 2 hours of lectures per week

b. Turn in assignments and projects as considered suitable by the tutors

c. Complete continuous assessment which involves mid-semester test

d. Complete a 2-hour comprehensive final examination at the end of the semester.

h) Methods of Lecture Delivery/Teaching Aids

Lecture Delivery Methods

Educator-Student Interaction (Discussion method)

Teaching Aids

Visual Aids (Use of PowerPoint slides, Lecture templates-handouts)

i) Course Content or Outline

Topics	Weeks
Mathematical Foundations • Complex Variables: Introduction, rectangular and polar forms, operations (addition, subtraction, multiplication, division). • Vectors and Orthogonal Functions: Vector space concepts, linear independence, orthogonality, basis functions.	1 - 2
Signals and Their Properties • Types and Classification of Signals: Continuous-time (CT) vs. Discrete-time (DT) signals, periodic vs. aperiodic signals, energy vs. power signals, deterministic vs. random signals. • Time and Frequency Domains: Signal representation in time and frequency domains, the relationship between time and frequency characteristics.	3 - 4
Signal Analysis Techniques • Transforms in Signal Analysis: • Fourier Series: Periodic signal representation, Fourier coefficients, even and odd functions, applications. • Fourier Transforms: Continuous-time and discrete-time Fourier transforms, signal spectrum analysis, properties of Fourier transforms. • Convolution: Definition, graphical and mathematical properties, applications in signal processing. • Power and Energy of Signals: Average power, instantaneous power, energy of signals.	5 - 7
Statistical Analysis of Signals • Probability Functions of Signals: Introduction to probability theory, probability density function (PDF), cumulative distribution function (CDF). • Correlation: Autocorrelation (measures similarity of a signal with itself), Cross-correlation (measures similarity between two signals).	8
Systems Analysis • Description and Analysis of Different Types of Systems: Static vs. Dynamic systems, Linear vs. Non-linear systems, Time-variant vs. Time-invariant (LTI) systems. • Analysis of Time Domain Systems: Impulse response, step response, system characterization. • Frequency-Domain System Analysis using the Laplace Transform: Laplace transform definition, properties, and applications to analyze LTI systems. • Continuous Time Convolutions: Properties and applications in system analysis.	9 - 10

Discrete-Time Systems and Applications • Discrete-Time Systems: Analysis of LTI discrete-time systems using difference equations. • Discrete Time Convolution and Transforms: Discrete convolution, Z-transform (definition, properties, applications in analyzing DT systems). • Sampling Theory: Sampling theorem, Nyquist-Shannon sampling rate, aliasing. • Sampling and Reconstruction: Techniques for the ideal and practical reconstruction of signals from their samples.	11 - 12
Lecture free week	13
Revision & Examination	14 - 15

j) Method of Grading Continuous Assessment

Continuous Assessment (Assignment): 10%

Continuous Assessment Test: 20%

End of Semester Examination: 70%

k) Tutorials

Tutorial will be offered at the end of each module.

l) Term Paper and Assignments

This course challenges you to tackle a real-world problem using the power of signal analysis. Apply the knowledge of Fourier transforms, convolution, and system analysis to propose solutions. Weekly assignments will solidify their understanding through calculations and simulations using tools like MATLAB or LabVIEW. Prepare to analyze signals in both time and frequency domains and explore the fascinating world of signal processing.

m) Contemporary Issues and Industrial Relevance

This course tackles contemporary issues like signal analysis and emerging communication systems. The grasp of signals and systems is crucial in industries like Electronic (signal integrity) and image/video processing. The skills gained are fundamental for control systems and robotics, making it highly relevant in today's technological world.

BOWEN UNIVERSITY, IWO
Faculty of Engineering
Department of Electrical/Electronic Engineering

Course Code: EEE 316 **Course Title:** Electrical Measurement and Instrumentation
Semester: Second **Credit Hours**: 2 hours
Contact Hours: Lecture - Two hours lectures per Week
Location: New Horizon **Lecturer(s)**: Dr. D. O. Akande
Textbooks and other Materials:

1. An Introduction to Electrical Instrumentation and Measurement Systems by *B.A. Gregory* 2nd edition, John Wiley & Sons, New York

a) Course Overview and description

This course serves as an introduction to the fundamental principles and techniques of measurement in engineering. This course provides students with a comprehensive understanding of measurement fundamentals and instrumentation techniques commonly used in engineering practice.

b) Pre-requisites: Nil

c) Co-requisite(s): Nil

d) Role in Curriculum: Elective

e) Course Learning Outcome (CLO) and Programme Outcomes (PO)

Course Learning Outcomes: upon successful completion of the course, students will be able to:	**Suitable Bloom Taxonomy Relevant to the CLOs**	**POs**	**Assessment Tools**
Understand the fundamentals of electrical measurement, units, and standards.	2	1, 3	Assignment, quizzes and Exams
Discuss the importance of grounding, shielding and noise reduction in electrical measurements.	2	6, 8	Assignment, quizzes and Exams
Illustrate the principle of operations of moving coil and moving iron instruments.	3	2, 4	Assignment, quizzes and Exams
Compare the difference between analog and digital electronic measuring instruments.	4	5	Assignment, quizzes and Exams
Apply bridge circuits in the accurate measurement of electrical components.	3	1, 4	Assignment, quizzes and Exams
Differentiate the different types of transducers and their purposes.	4	6	Assignment, quizzes and Exams
Interpret electrical measurements over time using recording instruments.	6	11	Assignment, quizzes and Exams

f) Mapping of CLOs to relevant POs

Course Learning Outcomes	**Programme Outcomes (POs):**											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Understand the fundamentals of electrical measurement, units, and standards.	**3**		**3**									
Discuss the importance of grounding, shielding and noise reduction in electrical measurements.						**3**		**2**				
Illustrate the principle of operations of moving coil and moving iron instruments.		**3**		**2**								
Compare the difference between analog and digital electronic measuring instruments.						**2**						
Apply bridge circuits in the accurate measurement of electrical components.	**3**			**2**								
Differentiate the different types of transducers and their purposes.						**2**						
Interpret electrical measurements over time using recording instruments.											**3**	

Keys: 1 = Slightly related, 2 = Moderately related, 3 = Highly related

g) Expectations of Students

a. Attend 2 hours of lectures per week
b. Turn in assignments and projects as considered suitable by the tutor
c. Complete continuous assessment which involves mid-semester test
d. Complete a 2-hour comprehensive final examination at the end of the semester.

h) Methods of Lecture Delivery/Teaching Aids

Lecture Delivery Methods

Educator-Student Interaction (Discussion and demonstration method)

Teaching Aids

Visual Aids (Use of PowerPoint slides, Lecture templates-handouts)

i) Course Content or Outline

Topics	Weeks
Introduction to Measurement Fundamentals • Introduction to Measurement - The scientific process, role of measurement, and different types of measurements (physical, electrical, chemical, etc.). • Units and Standards - Importance of units, SI units (Système international d'unités), prefixes, and fundamental and derived units. • Measurement Errors and Uncertainties - Classification of errors (systematic, random, gross), accuracy, precision, and methods to minimize errors.	1 - 3
Electrical Fundamentals and Instruments • Electrical Circuits - Basic electrical quantities (current, voltage, resistance, power), Ohm's Law, Kirchhoff's Current Law (KCL) and Kirchhoff's Voltage Law (KVL) for circuit analysis. • Moving Coil Instruments - Construction, principle of operation, types (ammeters, voltmeters), and applications. • Moving Iron Instruments - Construction, principle of operation, types (dynamometer, wattmeter), and applications.	4 - 6
Measurement Techniques and Instruments • Electrostatic Voltmeters - Construction, principle of operation, and applications for high voltage measurements. • AC and DC Bridges - Wheatstone bridge, Maxwell-Wien bridge, Schering bridge, applications for measuring resistance, capacitance, and inductance.	7 - 8
Signal Conditioning and Recording • Grounding and Shielding - Importance of grounding, types of grounding, shielding techniques to minimize noise and interference. • Noise in Measurements - Sources of noise (thermal, shot, flicker), methods to minimize noise and improve signal-to-noise ratio (SNR). • Recording Instruments - Analog and digital recorders (oscilloscopes, data loggers), selection criteria for recording instruments.	9 - 11
Sensors and Transducers • Measurement of Non-Electrical Quantities - Transducers, classification (active, passive), interfacing transducers with electrical instruments. • Applications of Transducers - Examples of transducers for measuring temperature, pressure, flow, displacement, etc.	12
Lecture free week	13
Revision & Examination	14 - 15

j) Method of Grading Continuous Assessment

Continuous Assessment (Assignment): 10%

Continuous Assessment Test: 20%

End of Semester Examination: 70%

k) Tutorials

Tutorial will be offered at the end of each module.

l) Term Paper and Assignments

The term paper and assignment series address on the fundamentals of accurate measurement and explore various instruments (moving coil, voltmeters, bridges) and techniques (grounding, shielding) to minimize noise and ensure reliable data acquisition for both electrical and non-electrical quantities through the application of using transducers.

m) Contemporary Issues and Industrial Relevance

This course focuses on the essential skills for accurate and reliable measurements in various fields. It will also prepare the students for practical applications across industries.

BOWEN UNIVERSITY, IWO
Faculty of Engineering
Department of Electrical/Electronic Engineering

Course Code: EEE 317
Course Title: Introduction to Entrepreneurship Studies for Electrical & Electronic Engineers
Semester: First
Credit Hours: 30 hours
Contact Hours: Lecture - Two hours lectures per Week
Location: Alma Rohr
Lecturer(s): Engr. Diarah. R. S.
Textbooks and other Materials:

1. *Entrepreneurship for Engineers* by Mark J. DeLong (2020)
2. *The Startup Owner's Manual: The Step-by-Step Guide for Building a Great Company by Steve* Blank and Bob Dorf (2019)

a) Course Overview and description

The course is structured in such a way to foster in-depth understanding of Electrical services and its relation to industries. Issues of Safety and Regulations of Electrical installations were given an in-depth consideration.

b) Pre-requisites: Nil

c) Co-requisite(s): Nil

d) Role in Curriculum: Core

e) Course Learning Outcome (CLO) and Programme Outcomes (PO)

Course Learning Outcomes: upon successful completion of the course, students will be able to:	**Suitable Bloom Taxonomy Relevant to the CLOs**	**POs**	**Assessment Tools**
Understand the different forms of business ownership (sole proprietorship, partnership, limited liability company) and their suitability for ventures in the technology sector.	2	11, 12	Homework, quizzes and Exams
Explain a basic business plan, including identifying capital requirements and sources of funding (loans, investors).	2	2, 5, 10	Homework, quizzes and Exams
Analyze financial feasibility and perform basic financial projections for a technology-based business.	4	2, 8	Homework, quizzes and Exams
Outline key legal issues relevant to starting a business in the technology sector (business registration, licensing, permits).	4	2, 5	Homework, quizzes and Exams
Understand basic contractual principles and their importance in business operations.	2	2, 6	Homework, quizzes and Exams

f) Mapping of CLOs to relevant POs

Course Learning Outcomes	**Programme Outcomes (POs):**											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Understand the different forms of business ownership (sole proprietorship, partnership, limited liability company) and their suitability for ventures in the technology sector.											**2**	**3**
Explain a basic business plan, including identifying capital requirements and sources of funding (loans, investors).				**2**	**3**					**3**		
Analyze financial feasibility and perform basic financial projections for a technology-based business.		**2**						**3**				
Outline key legal issues relevant to starting a business in the technology sector (business registration, licensing, permits).		**3**			**3**							
Understand basic contractual principles and their importance in business operations.		**2**				**3**						

Keys: 1 = Slightly related, 2 = Moderately related, 3= Highly related

g) Expectations of Students

a. Attend 2 hours of lectures per week
b. Turn in assignments and projects as considered suitable by the tutors
c. Complete continuous assessment which involves mid-semester test
d. Complete a 2-hour comprehensive final examination at the end of the semester.

h) Methods of Lecture Delivery/Teaching Aids

Lecture Delivery Methods

Educator-Student Interaction (Discussion method) Video Tutorials Electrical systems

Teaching Aids

Visual Aids (Use of PowerPoint slides, Lecture templates-handouts)

i) Course Content or Outline

Topics	Weeks
Business Planning and Ownership • Explore various technology-based business opportunities across different industries. • Discuss factors influencing business success in the technology sector. • Analyze different forms of business ownership (sole proprietorship, partnership, limited liability company) and their advantages/disadvantages. • Guide students in selecting the most suitable ownership structure for their chosen venture. • Introduce the concept of a business plan and its importance for securing funding. • Breakdown key components of a business plan: market analysis, marketing strategy, financial projections.	1 - 3
Capital Acquisition and Financial Management • Identify and estimate the different types of capital required to start a technology business (initial investment, operational costs). • Analyze funding sources (bootstrapping, loans, investors) and their characteristics. • Introduce basic financial tools for projecting revenue, expenses, and profitability. • Analyze financial feasibility of a business idea based on projections. • Discuss basic financial management practices for technology businesses (cash flow management, budgeting).	4 - 6
Legal and Regulatory Environment • Explain the process of business registration and obtaining necessary licenses/permits for technology ventures. • Discuss legal requirements specific to different technology sectors (e.g., data privacy). • Introduce basic contractual principles and their importance in business operations. • Demystify intellectual property (IP) concepts like copyrights, patents, and trademarks, and their role in protecting technology-based innovations. • Analyze real-world legal cases related to technology businesses. • Invite a lawyer specializing in technology law for a guest lecture (optional).	7 - 9
Risk Management and Industry Considerations • Discuss the importance of risk identification and mitigation for technology businesses (e.g., cyber security, data breaches). • Analyze different types of insurance relevant to the technology sector (property, liability, cyber insurance).	10 - 12

• Guide students in selecting appropriate insurance coverage for their ventures. • Highlight environmental regulations applicable to technology businesses (e.g., e-waste disposal). • Discuss sustainable business practices in the technology sector.	
Lecture free week	13
Revision & Examination	14 - 15

j) Method of Grading Continuous Assessment

Continuous Assessment (Assignment): 10%
Continuous Assessment Test: 20%
End of Semester Examination: 70%

k) Tutorials

Tutorial will be offered at the end of each module.

l) Term Paper and Assignments

· Term papers and assignments were given to students of each module.

m) Contemporary Issues and Industrial Relevance

In today's rapidly evolving technological landscape, electrical and electronic engineers (EEEs) are uniquely positioned to identify and address emerging needs through innovative solutions. An Introduction to Entrepreneurship Studies equips these engineers with the skills and knowledge to translate their technical expertise into successful businesses. Here's why this combination is so relevant:

Contemporary Issues:

- **Rapid Technological Change:** EEEs are at the forefront of technological advancements, and entrepreneurial skills allow them to capitalize on these innovations by turning them into viable commercial products.
- **Growing Demand for Hardware Solutions:** The Internet of Things (IoT), artificial intelligence (AI), and other emerging fields require hardware solutions. EEEs can bridge the gap between theoretical concepts and practical applications through entrepreneurial ventures.
- **Shifting Job Market:** While traditional engineering jobs remain important, the rise of automation and outsourcing requires engineers to develop additional skillsets. Entrepreneurship provides EEEs with alternative career paths and the potential for greater control over their careers.

Industrial Relevance:

- **Product Development and Commercialization:** EEEs with entrepreneurial skills can transform inventions into marketable products by understanding market needs, conducting feasibility studies, and attracting funding.
- **Building and Leading Technology-Driven Businesses:** Entrepreneurial training empowers EEEs to build teams, manage resources, and develop business plans to navigate the complexities of bringing a new technology to market.

- **Funding and Investment Opportunities:** Understanding venture capital, angel investors, and other funding options is crucial for EEEs to secure the resources needed to launch and scale their businesses.
- **Disruptive Innovation:** The ability to identify unmet needs and develop disruptive technologies is a key strength of entrepreneurial engineers. They can create entirely new markets by leveraging their technical expertise.

BOWEN UNIVERSITY, IWO
Faculty of Engineering
Department of Electrical/Electronic Engineering

Course Code: EEE 300 **Course** Students Work Experience Programme II
Semester: Second **Credit Hours**: 2
Contact Hours: Practicals - 30 hours lectures per Week
Location: Engineering Workshop **Lecturer(s)**: All Staff
Textbooks and other Materials:

1. *Entrepreneurship for Engineers* by Mark J. DeLong (2020)

The Industrial Training Fund (ITF) publishes guidelines and information booklets on SIWES which can be found on their website https://www.siwes.itf.gov.ng/Identity/LandingPage/siwes.

a) Course Overview and description
The course is structured in such a way to foster in-depth understanding of Electrical services and its relation to industries. Issues of Safety and Regulations of Electrical installations were given an in-depth consideration.

b) Pre-requisites: Nil
c) Co-requisite(s): Nil
d) Role in Curriculum: Core
e) Course Learning Outcome (CLO) and Programme Outcomes (PO)

Course Learning Outcomes: upon successful completion of the course, students will be able to:	**Suitable Bloom Taxonomy Relevant to the CLOs**	**POs**	**Assessment Tools**
Demonstrate proficiency in at least any three software in their chosen career choices;	3	1, 2, 12	Practical and Oral Exams
Demonstrate proficiency in some animation videos (some of which are free on YouTube) in their chosen careers	3	1, 2, 8	Practical and Oral Exams
Carry out outdoor hands-on construction activities to sharpen their skills in their chosen careers;	3	1, 3, 4, 11	Practical and Oral Exams
Demonstrate proficiency in generating data from laboratory analysis and develop empirical models;	3	1, 10, 12	Practical and Oral Exams
Demonstrate proficiency in how to write engineering reports from lab work;	3	4, 5, 6, 12	Practical and Oral Exams
Generate logbooks of all experience gained in their chosen careers;	5	7, 9	Practical and Oral Exams
Justify report presentation and defense	6	8, 12	Practical and Oral Exams

f) Mapping of CLOs to relevant POs

Course Learning Outcomes	Programme Outcomes (POs)											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Demonstrate proficiency in at least any three software in their chosen career choices;	**3**	3										**2**
Demonstrate proficiency in some animation videos (some of which are free on YouTube) in their chosen careers	3	2						2				
Carry out outdoor hands-on construction activities to sharpen their skills in their chosen careers;	3		3	3							2	
Demonstrate proficiency in generating data from laboratory analysis and develop empirical models;	3									3		2
Demonstrate proficiency in how to write engineering reports from lab work;				2	2	3						
Generate logbooks of all experience gained in their chosen careers;							3		3			
Justify report presentation and defense								2				2

Keys: 1 = Slightly related, 2 = Moderately related, 3= Highly related

g) Expectations of Students

a. Attend 30 hours of Workshop practice per week

b. Turn in assignments and projects as considered suitable by the tutors

c. Complete continuous assessment which involves mid-semester test

d. Complete a 2-hour comprehensive final examination at the end of the programme.

h) Methods of Lecture Delivery/Teaching Aids

Lecture Delivery Methods

Workshop /Laboratory

i) Course Content or Outline

Topics	Weeks
Acquire work experience outside of the university	1- 8
Report presentation and defense	

j) Method of Grading Continuous Assessment

Students work presentation and defense.

k) Tutorials

Workshop/ practice

l) Term Paper and Assignments

Log-book filling and report writing.

m) Contemporary Issues and Industrial Relevance

Contemporary Issues:

- Generic Placements: SWEPs might struggle to secure placements that offer students experience specific to their field of study. This can lead to generic work tasks that don't contribute much to their professional development.
- Short-term Focus: SWEPs are often short-term programs, making it difficult for students to get deeply involved in complex projects or develop a strong understanding of industry processes.
- Lack of Mentorship: Without proper mentorship during the program, students may miss out on valuable guidance and opportunities to learn from experienced professionals.
- Unpaid Work: If SWEPs are unpaid, it can create challenges for students from disadvantaged backgrounds who may struggle to afford living expenses during the program.

Maintaining Industrial Relevance:

- Focus on Skills, not Tasks: Shifting the focus from completing specific tasks to developing relevant skills can make the program more adaptable to different work environments.
- Micro-internships: Exploring shorter, project-based placements can offer students exposure to specific industry challenges and problem-solving opportunities.
- Virtual Work Opportunities: Integrating virtual work experiences allows students to gain exposure to remote work settings, a growing trend in many industries.
- Soft Skills Development: SWEPs should prioritize the development of soft skills like communication, teamwork, and critical thinking, which are valuable across all industries.

Bridging the Gap:

- Industry Collaboration: Partnerships between universities and companies can help design SWEPs that offer targeted learning experiences aligned with industry needs.
- Skill-based Matching: Matching students' skills and interests with appropriate work placements can lead to more focused and relevant experiences.
- Online Learning Integration: Combining work experience with online learning modules can provide students with a deeper understanding of the theoretical underpinnings of their practical work.
- Feedback and Reflection: Encouraging regular feedback from supervisors and providing opportunities for reflection can help students solidify their learning and identify areas for further development.

BOWEN UNIVERSITY, IWO
Faculty of Engineering
Department of Electrical/Electronic Engineering

Course Code: EEE 401 **Course Title:** Communication Principles
Semester: First **Credit Hours**: 3 hours
Contact Hours: Lecture - Three hours lectures per Week
Location: New Horizon Studio 3 **Lecturer(s)**: Dr. D. O. Akande
Textbooks and other Materials:

Communication Systems Engineering" by John G. Proakis and Masoud Salehi, (2002), Prentice Hall, Inc.

a) Course Overview and description

This course introduces the core principles of communication systems, exploring how information is transmitted (modulation & multiplexing) and recovered (demodulation). It in addition, analyze various modulation techniques (AM, FM, etc.) and delve into digital communication fundamentals like sampling, coding, and keying methods.

b) Pre-requisites:

c) Co-requisite(s): Nil

d) Role in Curriculum: Core

e) Course Learning Outcome (CLO) and Programme Outcomes (PO)

Course Learning Outcomes: upon successful completion of the course, students will be able to:	**Suitable Bloom Taxonomy Relevant to the CLOs**	**POs**	**Assessment Tools**
Understand the block diagram of a communication system and its classification.	2	1, 2, 3, 5, 9	Assignment, quizzes and Exams
Differentiate the different types of modulations techniques, state how they differ and identify the limitations in their application.	4	1, 2, 6, 9	Assignment, quizzes and Exams
Contrast the broadcast bands and specifications of different modulation techniques.	4	1, 6,	Assignment, quizzes and Exams
Apply sampling principles and techniques.	3	1, 2, 5	Assignment, quizzes and Exams
Explain multiplexing techniques in communication systems.	3	1, 2, 3, 10	Assignment, quizzes and Exams
Assess the advantages of coding.	6	2, 3	Assignment, quizzes and Exams

f) Mapping of CLOs to relevant POs

Course Learning Outcomes	**Programme Outcomes (POs)**											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Understand the block diagram of a communication system and its classification.	**3**	**3**	**3**		**3**				**3**			
Differentiate the different types of modulations techniques, state how they differ and identify the limitations in their application.	**3**	**3**				**3**				**3**		
Contrast the broadcast bands and specifications of different modulation techniques.	**2**				**2**							
Apply sampling principles and techniques.	**3**	**3**			**3**							
Explain multiplexing techniques in communication systems.	**3**	**3**	**3**							**3**		

Assess the advantages of coding.		**1**	**1**									

Keys: 1 = Slightly related, 2 = Moderately related, 3 = Highly related

g) Expectations of Students

a. Attend 3 hours of lectures per week

b. Turn in assignments and projects as considered suitable by the tutors

c. Complete continuous assessment which involves mid-semester test

d. Complete a 3-hour comprehensive final examination at the end of the semester.

h) Methods of Lecture Delivery/Teaching Aids

Lecture Delivery Methods

Educator-Student Interaction (Discussion, sketches, problems and simulation methods)

Teaching Aids

Visual Aids (Use of PowerPoint slides, Lecture templates-handouts)

i) Course Content or Outline

Topics	Weeks
Introduction and Fundamentals • Block Diagram Description of a Communication System - Elements like transmitter, receiver, channel, modulation, demodulation. • Classification of Communication Systems - Wireless vs. Wired, Analog vs. Digital, Baseband vs. Broadband.	1 - 2
Modulation Techniques • Introduction to Modulation - Need for modulation, basic principles. • Amplitude Modulation (AM) - DSBTC, DSBSC, SSB, VSB - modulation methods, characteristics, comparison. • Angle Modulation - Frequency Modulation (FM) and Phase Modulation (PM) - principles, characteristics, comparison. • Pulse Modulation - OAM, PWM, PFM - modulation methods, characteristics.	3 - 5
Demodulation and Noise • Demodulation Techniques - Principles, circuits for demodulating AM, FM, and PM signals. • Comparison of Modulation Systems - Trade-offs between different modulation techniques considering bandwidth, power efficiency, noise immunity. • Noise Figure - Concept of noise and its impact on communication systems, noise figure calculations.	6 - 7
Digital Transmission Fundamentals • Sampling Principles and Techniques - Nyquist-Shannon sampling theorem, aliasing, sampling techniques. • Pulse Code Modulation (PCM) and Delta Modulation - Digital representation of analog signals, PCM techniques, Delta modulation.	8 - 9
Multiplexing Techniques • Multiplexing - Need for multiplexing, Frequency Division Multiplexing (FDM), Time Division Multiplexing (TDM), Wavelength Division Multiplexing (WDM). • Shift Keying Techniques - Amplitude Shift Keying (ASK), Frequency Shift Keying (FSK), Phase Shift Keying (PSK) - principles, modulation methods.	10 - 11
Introduction to Coding • Error detection and correction techniques for reliable data transmission.	12
Lecture free week	13
Revision & Examination	14 - 15

j) Method of Grading Continuous Assessment

Continuous Assessment (Assignment): 10%

Continuous Assessment Test: 20%

End of Semester Examination: 70%

k) Tutorials

Tutorial will be offered at the end of each module.

l) Term Paper and Assignments

This term paper and assignment series delves into the core principles of communication systems. It explores various modulation techniques (AM, FM, etc.) used to transmit information and analyze methods for recovering that information (demodulation). The assignments focus on applying these concepts through calculations, simulations, or design projects, allowing you to gain a practical understanding of essential communication system components.

m) Contemporary Issues and Industrial Relevance

This course equips the students with the fundamentals of communication systems, where information travels through channels using techniques like modulation and multiplexing. It explores various methods for altering a carrier signal to encode information and how that information is retrieved. Furthermore, the course introduces digital communication principles like converting analog signals to digital form (sampling) and encoding data for transmission (coding), preparing them for the ever-evolving world of communication technologies.

BOWEN UNIVERSITY, IWO
Faculty of Engineering
Department of Electrical/Electronic Engineering

Course Number: EEE 403
Course Title: Control Engineering Principles
Semester: First
Credit Hours: 3 hours
Contact Hours: Lecture - Three hours of lectures per Week
Location: New Horizon
Lecturer(s): Engr Ogundoyin, S. O.
Textbooks and other Materials:

1. *Norman, S. Nise* (2015) Control Systems Engineering, Seventh Edition, Wiley & Sons, Inc.

a) Course Overview and description

This course equips you to analyze and design systems that regulate behaviour, from mechanical processes to electrical circuits. You'll learn how to model systems mathematically, analyze stability, and use tools like Bode plots and root locus to predict system response. This knowledge is fundamental for designing control systems in various engineering fields.

b) Pre-requisites: Nil

c) Co-requisite(s): Nil

d) Role in Curriculum: Core

e) Course Learning Outcome (CLO) and Programme Outcomes (PO)

Course Learning Outcomes: upon successful completion of the course, students will be able to:	**Suitable Bloom Taxonomy Relevant to the CLOs**	**POs**	**Assessment Tools**
Apply differential equations and transfer functions to model typical electrical, mechanical, thermal, and fluid systems.	3	1, 2	Assignments, quizzes and Exams
Generate block and signal flow diagrams to represent feedback systems and their components.	5	1, 3, 5	Assignments, quizzes and Exams
Construct the poles and zeros, root locus, Bode, Nyquist, and Nichols plots for basic stability concepts in control systems.	5	1, 3, 5	Assignments, quizzes and Exams
Develop closed-loop performance analysis using frequency response in control systems synthesis.	5	1, 4	Assignments, quizzes and Exams
Design basic closed-loop control system performance using the Bode plot and root locus and their applications in stability and regulation.	5	1, 5	Assignments, quizzes and Exams

f) Mapping of CLOs to relevant POs

Course Learning Outcomes	Programme Outcomes (POs)											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Apply differential equations and transfer functions to model typical electrical, mechanical, thermal, and fluid systems.	**3**	**3**										
Generate block and signal flow diagrams to represent feedback systems and their components.	**3**		**3**		**3**							
Construct the poles and zeros, root locus, Bode, Nyquist, and Nichols plots for basic stability concepts in control systems.	**3**		**3**		**2**							
Develop closed-loop performance analysis using frequency response in control systems synthesis.	**3**			**3**								
Design basic closed-loop control system performance using the Bode plot and root locus and their applications in stability and regulation.	**3**				**3**							

Keys: 1 = Slightly related, 2 = Moderately related, 3= Highly related

g) Expectations of Students

a. Attend 3 hours of lectures per week

b. Turn in assignments and projects as considered suitable by the tutors

c. Complete continuous assessment which involves mid-semester test

d. Complete a 3-hour comprehensive final examination at the end of the semester.

h) Methods of Lecture Delivery/Teaching Aids

Lecture Delivery Methods

Educator-Student Interaction (Discussion method and analogies)

Teaching Aids

Visual Aids (Use of PowerPoint slides, Lecture templates-handouts)

i) Course Content or Outline

Topics	Weeks
Introduction and Fundamentals • Introduction to Control Systems Engineering: Definition, types of control systems (open-loop vs. closed-loop), applications in various engineering fields. • Differential Equations and Transfer Functions: Modeling physical systems using differential equations, and Laplace transforms for deriving transfer functions.	1 - 2
Modeling of Physical Systems • Models of Typical Electrical Systems: DC motors, AC motors, generators. • Models of Typical Mechanical Systems: Rotational systems, translational systems. • Models of Thermal Systems: First-order and second-order thermal systems. • Models of Fluid Systems: Liquid level control, hydraulic systems.	3 - 4
Block Diagrams and Signal Flow Analysis • Block Diagrams: Representing control systems using block diagrams, and block reduction techniques. • Signal Flow Diagrams: Representing control systems with signal flow for multi-variable analysis.	5
Feedback Control Systems and Stability • Feedback System Representation: Positive vs. negative feedback, closed-loop vs. open-loop systems. • Basic Stability Concepts: Steady-state error analysis, Routh-Hurwitz stability criterion. • Poles and Zeros: Significance of poles and zeros in transfer functions, and their impact on system response.	6 - 7
Frequency Domain Analysis Techniques • Root Locus Method: Graphical method for analyzing system stability and transient response. • Bode Plot: Analysis of frequency response using Bode plots, gain and phase margins. • Nyquist Plot: Graphical stability analysis using the Nyquist criterion. • Nichols Plot: Combined Bode and phase plot for controller design (introduction).	8 - 10
Control System Performance and Design • Closed Loop Performance Analysis using Frequency Response: Understanding system characteristics (bandwidth, rise time, settling time) from frequency response plots. • Introduction to Control System Synthesis: Introduction to PID control design, lead and lag compensators (basic concepts).	11 -12
Lecture free week	13
Revision & Examination	14 - 15

j) Method of Grading Continuous Assessment

Continuous Assessment (Assignment): 10%

Continuous Assessment Test: 20%

End of Semester Examination: 70%

k) Tutorials

Tutorial will be offered at the end of each module.

l) Term Paper and Assignments

This course lets you design a control system for a real-world application. Apply your knowledge of modelling, stability analysis, and frequency response to propose a solution. Weekly assignments solidify your understanding through calculations, building block diagrams, and potential simulations, just like in real-world engineering.

m) Contemporary Issues and Industrial Relevance

This course tackles hot topics like advanced manufacturing and autonomous systems, where precise control is key. Your grasp of control systems is crucial in diverse industries, from robotics and aerospace to process control in power plants and chemical engineering. The skills you gain are fundamental for designing tomorrow's intelligent systems.

BOWEN UNIVERSITY, IWO
Faculty of Engineering
Department of Electrical/Electronic Engineering

Course Number: EEE 405
Course Title: Electrical Power Principles
Semester: First
Credit Hours: 3 hours
Contact Hours: Lecture - Three hours of lectures per week
Location: New Horizon
Lecturer(s): Prof. O. A. Komolafe
Mr. John Babalola

Textbooks and other Materials:

1. "A Textbook of Electrical Technology " by *B. L. Theraja and B. A. Theraja*
2. "Electric Power Systems: A Concise Introduction" by *Stevenson Jr., William D.*
3. "Power System Analysis and Stability" by *Abhijit Chakrabarti and Sunita Halder*

a) Course Overview and description

The course is structured in such a way to foster in-depth understanding of Electrical services and its relation to industries. Issues of Safety and Regulations of Electrical installations were given an in-depth consideration.

b) Pre-requisites: EEE 304

c) Co-requisite(s): Nil

d) Role in Curriculum: Core

e) Course Learning Outcome (CLO) and Programme Outcomes (PO)

Course Learning Outcomes: upon successful completion of the course, students will be able to:	**Suitable Bloom Taxonomy Relevant to the CLOs**	**POs**	**Assessment Tools**
Analyze the principles and methods of electrical energy generation from various sources, including steam, water, wind, gas, MHD, nuclear, solar, and fossil fuels.	4	1, 3, 8	Homework, quizzes and Exams
Develop models of power system components~~,~~ including generators, transformers, transmission lines, and distribution networks. Design power system layouts considering grounding requirements and distribution strategies.	5	1, 3, 5, 6, 7	Homework, quizzes and Exams
Analyze the parameters of transmission lines and cables to understand their steady-state characteristics and behavior. Evaluate the impact of line parameters on power system performance and voltage regulation.	4	1, 3, 6	Homework, quizzes and Exams
Develop power flow calculation methods applicable to small reactance power systems.	5	1, 3, 5, 8	Homework, quizzes and Exams
Evaluate fault calculation methods for small power system networks using network reduction and similar techniques.	6	1, 3, 5, 7	Homework, quizzes and Exams
Evaluate power system protection schemes and instrumentation systems based on the general theory of power system protection.	6	1, 3, 8	Homework, quizzes and Exams

f) Mapping of CLOs to relevant POs

Course Learning Outcomes	**Programme Outcomes (POs):**											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Analyze the principles and methods of electrical energy generation from various sources, including steam, water, wind, gas, MHD, nuclear, solar, and fossil fuels.	**3**		**3**				**3**					
Develop models of power system components, including generators, transformers, transmission lines, and distribution networks. Design power system layouts considering grounding requirements and distribution strategies.	**3**		**3**		**3**	**2**	**3**					
Analyze the parameters of transmission lines and cables to understand their steady-state characteristics and behavior. Evaluate the impact of line parameters on power system performance and voltage regulation.	**3**		**3**			**2**						
Develop power flow calculation methods applicable to small reactance power systems.	**3**		**3**		**3**			**3**				
Evaluate fault calculation methods for small power system networks using network reduction and similar techniques.	**3**		**3**		**3**			**3**				
Evaluate power system protection schemes and instrumentation systems based on the general theory of power system protection.	**3**		**3**					**3**				

Keys: 1 = Slightly related, 2 = Moderately related, 3= Highly related

g) Expectations of Students

a. Attend 3 hours of lectures per week

b. Turn in assignments and projects as considered suitable by the tutors

c. Complete continuous assessment which involves mid-semester test

d. Complete a 3-hour comprehensive final examination at the end of the semester.

h) Methods of Lecture Delivery/Teaching Aids

Lecture Delivery Methods

Educator-Student Interaction (Discussion method) Video Tutorials Electrical systems

Teaching Aids

Visual Aids (Use of PowerPoint slides, Lecture templates-handouts)

i) Course Content or Outline

Topics	Weeks
• Overview of power systems: components, structure, and operation • Principles of electrical energy generation from steam, water, wind, gas, MHD, nuclear, solar, and fossil fuels • Introduction to other power sources: thermoelectric, photovoltaic cells, storage batteries • Discussion on the layout and representation of power systems	1 - 2
• Detailed study of power system components: generators, transformers, transmission lines, and distribution networks • Modeling of power system components using per unit representation techniques • Grounding strategies and distribution layouts in power systems	3 - 4
• Analysis of transmission line parameters: resistance, inductance, capacitance, and conductance • Steady-state behavior and characteristics of transmission lines • Calculations of voltage regulation and power losses in transmission lines	5 - 6
• Introduction to power flow analysis and its importance in power system operation and planning • Development of power flow calculation methods applicable to small reactance power systems	7 - 8
• Understanding faults and their impact on power system operation • Introduction to methods for fault analysis on small networks using network reduction and similar techniques	9 - 10
• Overview of power system protection principles and requirements • Instrumentation techniques for monitoring and control of power system parameters • Review of key concepts covered in the course • Preparation for final assessments and examinations	11-12
Lecture free week	13
Revision & Examination	14 - 15

j) Method of Grading Continuous Assessment

Continuous Assessment (Assignment): 10%
Continuous Assessment Test: 20%
End of Semester Examination: 70%

k) Tutorials

Tutorial will be offered at the end of each module.

l) Term Paper and Assignments

Term Paper:

A well-structured term paper (10-15 pages) with proper referencing including relevant diagrams and figures calculations to support their explanation would be required of them at the end of module 3 (end of week 5) and expected to be turned in middle of the Module 6 (End of week 11)

Assignments:

Assignments will be given at the end of each module on the topics discussed in the module.

m) Contemporary Issues and Industrial Relevance

Contemporary Issues:

- Renewable Energy Integration: This course delves into the challenges of integrating renewable energy sources with the existing power grid. These sources are variable and require new methods for system management and control.

Industrial Relevance:

- Energy Transition and Decarbonization: Industries are investing in technologies and strategies to transition to cleaner energy sources and reduce carbon emissions, driving the need for expertise in power system analysis to optimize renewable energy integration, grid operation, and energy efficiency.
- Power System Engineering Jobs**:** The knowledge gained in this course is directly applicable to a wide range of power system engineering jobs. Graduates can work on designing, building, and operating power plants, transmission lines, and distribution systems.

BOWEN UNIVERSITY, IWO
Faculty of Engineering
Department of Electrical/Electronic Engineering

Course Number: EEE 407
Course Title: Power Electronic
Semester: First
Credit Hours: 2
Contact Hours: Lecture – Two hours of lectures per Week
Location: New Horizon
Lecturer(s): Prof. O. A. Komolafe
Mr. J. O. Babalola

Textbooks and other Materials:

a) Course Overview and description

This course equips students with the knowledge and skills to design and analyze power conversion circuits. The course covers various power semiconductor switches, their characteristics, and selection criteria. Students learn to design and analyze AC-DC and DC-DC converters, including rectifiers, buck, boost, buck-boost, and flyback converters. Additionally, the course explores DC-AC inverters using PWM for single-phase and three-phase power conversion. It also covers resonant converters, switching power supplies, electrical isolation, protection circuits, and considerations for power line disturbances and power conditioning systems.

b) Pre-requisites: Nil

c) Co-requisite(s): Nil

d) Role in Curriculum:

e) Course Learning Outcome (CLO) and Programme Outcomes (PO)

Course Learning Outcomes: upon successful completion of the course, students will be able to:	**Suitable Bloom Taxonomy Relevant to the CLOs**	**POs**	**Assessment Tools**
Analyze and design power electronic circuits using various semiconductor switches like diodes, thyristors, MOSFETs, GTOs, and IGBTs.	4	1, 2	Assignments, quizzes and Exams
Assess the principles of DC-DC switch-mode converters, including buck, boost, buck-boost, and flyback converters, and design them for specific voltage conversion requirements.	6	1, 2, 3	Assignments, quizzes and Exams
Design and implement switch-mode DC-AC inverters using pulse-width modulation (PWM) for single-phase and three-phase power conversion.	6	1, 3	Assignments, quizzes and Exams
Analyze and design resonant converters for power conversion applications.	4	1, 2, 3	Assignments, quizzes and Exams
Design the operation of switching power supplies, including electrical isolation, protection circuits, and considerations for power line disturbances and power conditioning.	5	1, 3, 5	Assignments, quizzes and Exams

f) Mapping of CLOs to relevant POs

Course Learning Outcomes	Programme Outcomes (POs):											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Analyze and design power electronic circuits using various semiconductor switches like diodes, thyristors, MOSFETs, GTOs, and IGBTs.	**3**		**3**									
Assess the principles of DC-DC switch-mode converters, including buck, boost, buck-boost, and flyback converters, and design them for specific voltage conversion requirements.	**3**	**2**	**3**									
Design and implement switch-mode DC-AC inverters using pulse-width modulation (PWM) for single-phase and three-phase power conversion.	**3**		**3**									
Analyze and design resonant converters for power conversion applications.	**3**	**2**	**3**									
Design the operation of switching power supplies, including electrical isolation, protection circuits, and considerations for power line disturbances and power conditioning.	**3**		**3**		**2**							

Keys: 1 = Slightly related, 2 = Moderately related, 3= Highly related

g) Expectations of Students

a. Attend 2 hours of lectures per week

b. Turn in assignments and projects as considered suitable by the tutors

c. Complete continuous assessment which involves mid-semester test

d. Complete a 2-hour comprehensive final examination at the end of the semester.

h) Methods of Lecture Delivery/Teaching Aids

Lecture Delivery Methods

Educator-Student Interaction (Discussion method and analogies)

Teaching Aids

Visual Aids (Use of PowerPoint slides, Lecture templates-handouts)

i) Course Content or Outline

Topics	Weeks
Power Semiconductor Switches • Overview of power Electronic and its applications in power conversion and control. • Classification of power electronic circuits: AC-DC, DC-AC, DC-DC converters. • Power quality and its importance in power Electronic systems. • Introduction to power semiconductor devices: diodes, thyristors, MOSFETs, GTOs, IGBTs. • Operating principles, characteristics, and switching behaviour of each device type. • Comparison of power semiconductor switches and their selection criteria.	1-2
Desired Characteristics in Controllable Switches • On-state resistance, voltage drop, switching speed, and power handling capability. • Gate control requirements and drive circuits for controllable switches. • Snubber circuits for protection against voltage spikes and transients.	3
Line-Commutated Diode Rectifiers, Phase-Controlled Rectifiers and Inverters • Operation and analysis of single-phase and three-phase diode bridge rectifiers. • Inrush current and over-voltage issues at turn-on. • Line-current harmonics and power factor correction techniques. • Principle of phase control using thyristors for AC voltage regulation. • Single-phase and three-phase phase-controlled rectifiers and inverters. • Harmonic analysis and power factor improvement in phase-controlled converters.	4-5
DC-DC Switch-Mode Converters and Switch-Mode DC-AC Inverters • Basic principles of switch-mode DC-DC converters: buck, boost, buck-boost, and flyback converters. • Operating modes, steady-state analysis, and voltage conversion ratios. • Design considerations for switch-mode converters: duty cycle control, inductor and capacitor selection. • Introduction to pulse-width modulation (PWM) for controlling DC-AC inverters. • Single-phase and three-phase PWM inverters: circuit topologies and control strategies. • Effect of blanking time on output voltage in PWM inverters.	6-7
Resonant Converters • Basic concepts of resonant converters and their advantages over PWM converters. • Classification of resonant converters: series resonant, parallel resonant, and LLC resonant converters. • Operating principles and analysis of basic resonant converter topologies.	8
Power Supply Design, Specifications and Line Disturbances • Switching power supply (SMPS) architecture and its advantages over linear power supplies. • Electrical isolation techniques in power supplies: transformers and optocouplers.	9-10

• Protection circuits for over-current, over-voltage, and short-circuit protection. • Power supply specifications: output voltage regulation, ripple, transient response, and efficiency. • Power line disturbances: sags, swells, transients, and harmonics. • Power conditioners and uninterruptible power supply (UPS) systems.	
Advanced Power Electronic Topics • High-frequency power converters and their applications. • Soft-switching techniques for reducing switching losses. • Multi-level inverters and their advantages for high-power applications.	11
Computer-Aided Design (CAD) of Power Electronic Circuits • Introduction to CAD tools for power Electronic circuit analysis and simulation. • Design optimization techniques for power converters using simulation software. • Thermal management considerations in power electronic circuits.	12
Lecture free week	13
Revision & Examination	14 - 15

j) Method of Grading Continuous Assessment

Continuous Assessment (Assignments): 20%

Continuous Assessment (Test): 15%

End of Semester Examination: 70%

k) Tutorials

Tutorials are taken at the end of each module.

l) Term Paper and Assignments

The term paper challenges students to research, analyze, and present findings on a chosen topic, demonstrating understanding and application of the learned concepts. Regular assignments throughout the course will reinforce theoretical knowledge and practical skills. These assignments will cover power electronic circuit analysis, design, and simulation, providing opportunities for independent problem-solving and application of learned principles.

m) Contemporary Issues and Industrial Relevance

This course investigates the role of power Electronic in addressing contemporary industrial challenges. Students will explore how these circuits are crucial in renewable energy systems, electric vehicles, and high-efficiency power conversion. The course emphasizes the need for miniaturization, energy efficiency, and power quality improvement, demonstrating how power electronic design skills contribute to innovative solutions for the evolving energy landscape and a sustainable future.

BOWEN UNIVERSITY, IWO
Faculty of Engineering
Department of Electrical/Electronic Engineering

Course Code: EEE 413
Course Title: Microprocessor and Microcomputer
Semester: First
Credit Hours: 2
Contact Hours: Lecture - Two hours of lectures per Week
Location: Alma Rohr
Lecturer(s): Prof. Clement Onime & Engr. Diarah. R. S

Textbooks and other Materials:

1. **Computer Organization and Design: The Hardware/Software Interface** by David A. Patterson and John L. Hennessy
2. **Introduction to Microprocessors and Embedded Systems** by Muhammad Ali Mazidi, Janice Gillispie Mazidi, and Rolin McKinlay
3. **The Essentials of Computer Organization and Architecture** by Linda Null and Julia Lobur

a) Course Overview and description

This course provides a foundational understanding of microprocessors, their history, architecture, and applications. It equips students with the knowledge to design and develop microprocessor-based systems.

b) Pre-requisites: Nil

c) Co-requisite(s): Nil

d) Role in Curriculum: Core

e) Course Learning Outcome (CLO) and Programme Outcomes (PO)

Course Learning Outcomes: upon successful completion of the course, students will be able to:	**Suitable Bloom Taxonomy Relevant to the CLOs**	**POs**	**Assessment Tools**
Explain elements of computers and microcomputers;	2	1, 2	Homework, quizzes and Exams
Outline the internal architecture of microcomputers;	4	1, 2	Homework, quizzes and Exams
Develop basic microprocessor instruction sets;	5	1, 2	Homework, quizzes and Exams
Execute and debug instruction sets	4	1, 2	Homework, quizzes and Exams
Assess the suitability of algorithms for microprocessor implementation; and	6	1, 2	Homework, quizzes and Exams
Demonstrate the architecture and functional block of microcontroller	3	1, 2	Homework, quizzes and Exams

f) Mapping of CLOs to relevant POs

Course Learning Outcomes	**Programme Outcomes (POs):**											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Explain elements of computers and microcomputers;	**3**	**3**										
Outline the internal architecture of microcomputers;	**3**	**2**										
Develop basic microprocessor instruction sets;	**2**	**3**										
Execute and debug instruction sets	**2**	**3**										
Assess the suitability of algorithms for microprocessor implementation; and	**3**	**2**										

Keys: 1 = Slightly related, 2 = Moderately related, 3= Highly related

g) Expectations of Students

a. Attend 2 hours of lectures per week

b. Turn in assignments and projects as considered suitable by the tutors

c. Complete continuous assessment which involves mid-semester test

d. Complete a 2-hour comprehensive final examination at the end of the semester.

h) Methods of Lecture Delivery/Teaching Aids

Lecture Delivery Methods

Educator-Student Interaction (Discussion method) Video Tutorials Electrical systems

Teaching Aids

Visual Aids (Use of PowerPoint slides, Lecture templates-handouts)

i) Course Content or Outline

Topics	Weeks
Introduction and Historical Context • Define microprocessors and their role in digital systems. • Discuss the advantages of microprocessors over traditional computers. • Explore the evolution of digital computers from mechanical calculators to electronic computers. • Analyze the development of microcomputers and their impact on technology	1 - 2
Microprocessor Architecture and Building Blocks • Introduce the basic architecture of a microprocessor, including Control unit (CU), Arithmetic Logic Unit (ALU), Registers, Memory, Input/Output (I/O) • Explain the function and operation of essential digital building blocks: • Registers (data storage), Counters (sequential logic), Clocks (synchronization) Combinational logic gates (AND, OR, NOT, etc.) • Analyze the hardware components of a microprocessor in detail: Data bus, address bus, control bus, Instruction Set Architecture (ISA)	3 - 5
System Design and Programming • Explain how microprocessors are integrated into digital systems. • Discuss interfacing techniques for memory and peripheral devices. • Define algorithms and analyze their suitability for implementation on microprocessors. • Introduce the concept of instruction sets and addressing modes. • Explain the role of software development tools for microprocessors (assemblers, compilers). • Differentiate between different types of microprocessor software: • Assembly language • Embedded C	6 - 8
Applications and Case Studies • Basic concepts of programming microprocessors (simple instructions, loops, branching). • Hands-on laboratory exercises using a microprocessor development environment (optional). • Explore diverse applications of microprocessors in various fields: • Embedded systems (e.g., smart devices, controllers) • Data acquisition systems, Industrial control systems • Analyze case studies showcasing real-world applications of microprocessors. • Invite a guest speaker from the industry to discuss practical applications of microprocessors.	9 - 12
Lecture free week	13
Revision & Examination	14 - 15

j) Method of Grading Continuous Assessment

Continuous Assessment (Assignment): 10%

Continuous Assessment Test: 20%

End of Semester Examination: 70%

k) Tutorials

Tutorial will be offered at the end of each module.

l) Term Paper and Assignments

Class work and Assignment would be conducted.

m) Contemporary Issues and Industrial Relevance

The field of microprocessors continues to evolve rapidly, playing a central role in shaping various contemporary issues and driving industrial advancements. Here's how an Introduction to Microprocessors course remains highly relevant:

Contemporary Issues:

- **Internet of Things (IoT):** The ever-growing number of interconnected devices relies on microprocessors for intelligent control and data processing. Understanding microprocessors is crucial for developing efficient and reliable IoT devices.
- **Artificial Intelligence (AI) and Machine Learning (ML):** Microprocessors with increasing processing power and specialized architectures are needed to run complex AI algorithms on the edge (closer to where data is generated) rather than relying solely on cloud computing.
- **Cybersecurity:** As microprocessors become more ubiquitous, security vulnerabilities can have a significant impact. Microprocessor design needs to consider security features to protect against cyberattacks.
- **Energy Efficiency:** The growing demand for portable and battery-powered devices requires low-power microprocessors for improved battery life and sustainability.

Industrial Relevance:

- **Embedded Systems Design:** Microprocessors are the heart of most embedded systems used in various industries, from automotive and aerospace to medical devices and consumer Electronic. Understanding microprocessors is essential for developing these embedded systems.
- **Processor Design and Innovation:** The semiconductor industry constantly strives for increased performance, efficiency, and miniaturization of microprocessors. Knowledge of microprocessor architecture and functionalities is key for engineers involved in processor design and innovation.
- **Hardware-Software Integration:** Microprocessor-based systems require seamless integration between hardware and software components. This course lays the foundation for engineers to work effectively in both domains.
- **Emerging Technologies:** Microprocessors play a vital role in advancements like wearable technology, autonomous vehicles, and robotics. This course equips students with the fundamental understanding necessary to adapt to and contribute to such emerging technologies.

BOWEN UNIVERSITY, IWO
Faculty of Engineering
Department of Electrical/Electronic Engineering

Course Code: EEE 415
Course Title: Electrical Maintenance and Repairs of Equipment
Semester: First
Credit Hours: 2 hours
Contact Hours: Lecture - Two hours of lectures per Week
Location: New Horizon
Lecturer(s): Dr. S. I. Ojo
Textbooks and other Materials:

1. Installation Maintenance and Repair of Electrical Machines and Equipment 2nd Edition by Madhvi Gupta.
2. Electrical Maintenance and Repairs in Industries by Ismail Adubazi Yusuf

a) Course Overview and description

This course provides an overview of electrical tools and equipment essential for maintenance and repairs, covering topics such as maintenance purposes, types, and procedures, along with ground rules for appliance repair and troubleshooting techniques for small appliances. Additionally, it delves into electrical safety practices, maintenance procedures for plants, repairs of electrical motors, radio receivers, and other major equipment, supplemented with case studies from the Electrical repairs unit to reinforce learning.

b) Pre-requisites: Nil

c) Co-requisite(s): Nil

d) Role in Curriculum: Core

e) Course Learning Outcome (CLO) and Programme Outcomes (PO)

Course Learning Outcomes: upon successful completion of the course, students will be able to:	**Suitable Bloom Taxonomy Relevant to the CLOs**	**POs**	**Assessment Tools**
Demonstrate proficiency in identifying and utilizing various electrical tools and equipment essential for maintenance and repair tasks in electrical systems.	3	2	Assignment, quizzes and Exams
Compare the purpose, types, and procedures involved in maintenance activities, including grounding rules, for appliances and electrical equipment, ensuring safe and effective operation.	4	3	Assignment, quizzes and Exams
Develop troubleshooting skills for diagnosing and resolving issues in small appliances, applying knowledge of electrical safety protocols to prevent hazards in maintenance and repair processes.	5	2	Assignment, quizzes and Exams
Apply maintenance techniques for plants and execute repairs on electrical motors, radio receivers, and other major electrical equipment, utilizing case studies to analyze real-world scenarios and solutions in the Electrical repairs unit.	3	1, 3	Assignment, quizzes and Exams

f) Mapping of CLOs to relevant POs

Course Learning Outcomes	Programme Outcomes (POs):											
	1	2	3	4	5	6	7	8	9	10	11	12
Demonstrate proficiency in identifying and utilizing various electrical tools and equipment essential for maintenance and repair tasks in electrical systems.		3										
Compare the purpose, types, and procedures involved in maintenance activities, including grounding rules, for appliances and electrical equipment, ensuring safe and effective operation.			3									
Develop troubleshooting skills for diagnosing and resolving issues in small appliances, applying knowledge of electrical safety protocols to prevent hazards in maintenance and repair processes.		3										
Apply maintenance techniques for plants and execute repairs on electrical motors, radio receivers, and other major electrical equipment, utilizing case studies to analyze real-world scenarios and solutions in the electrical repairs unit.	3		2									

Keys: 1 = slightly related, 2 = moderately related, 3 = highly related

g) Expectations of Students

a. Attend 2 hours of lectures per week

b. Turn in assignments considered suitable by the tutors

c. Complete continuous assessment which involves mid-semester test

d. Complete a $2^1/_2$-hour comprehensive final examination at the end of the semester.

h) Methods of Lecture Delivery/Teaching Aids

Lecture Delivery Methods

Educator-Student Interaction (Discussion method and analogies)

Teaching Aids

Visual Aids (Use of Power Point slides, Lecture templates-handouts)

i) Course Content or Outline

Topics	Weeks
Electrical tools and equipment for maintenance and repairs: • Electrical system maintenance • Tools needed for maintenance • Power tools • Hand tools	1-2
Maintenance: • Maintenance and repair of electrical equipment • Causes of Failures • Reliability factors • Purpose of Electrical maintenance • Objective of Maintenance • Maintenance strategy • Types of maintenance	3 - 5
Ground rules of Appliance repair: • Preliminary steps in testing and diagnosis electrical faulty • Safety rules for working with electrical equipment	6 - 8
Troubleshooting, Maintenance and Repairs of major electrical equipment. • Troubleshooting electrical appliances (Heating, motor, and combination) • Typical appliance cord connection (plugs, connectors, switches etc)	9
Electrical Safety • Electrical Hazard, danger and Damage • Electrical Shock • Electrical current • Electrical Emergencies • Electrical accidents • Electrical rescue techniques • Basic Electrical safety rules	10 -12
Case study of electrical repairs unit	13
Revision & Examination	14 - 15

j) Method of Grading Continuous Assessment

Continuous Assessment (Assignment): 10%
Continuous Assessment Test: 20%
End of Semester Examination: 70%

k) Tutorials

Tutorial will be offered at the end of each module.

l) Term Paper and Assignments

The term paper explored the essential electrical tools and equipment for maintenance and repair tasks, along with the purpose, types, and procedures of maintenance, including grounding rules and appliance repair protocols. Assignments will involve troubleshooting small appliances, focusing on electrical safety, and applying maintenance techniques to plants, as well as executing repairs on major electrical equipment with the aid of case studies from the Electrical repairs unit.

m) Contemporary Issues and Industrial Relevance

Understanding the contemporary relevance of electrical maintenance involves addressing emerging safety concerns and integrating modern technology into maintenance practices. The course also emphasizes the importance of efficient troubleshooting techniques and adherence to electrical safety standards to meet industry demands for reliable maintenance and repair services.

BOWEN UNIVERSITY, IWO
Faculty of Engineering
Department of Electrical/Electronic Engineering

Course Number: EEE 421

Course Title: Electrical/Electronic Laboratory and Mini-Project III

Semester: First

Credit Hours: 9 hours

Contact Hours: 9 hours of practical per Week

Location: Laboratories

Instructor(s): Supervising Lecturers and Lab Technologists

Textbooks and other Materials:

- Lab Manual

a) Course Overview and description

Laboratory experiments for Electronic, Control, Communication and Power Principles. This is to prepare the students for the SIWES programme in the following semester and long vacation.

b) Pre-requisites: EEE 311 & EEE 314

c) Co-requisite(s): New

d) Role in Curriculum: Core

e) Course Learning Outcome (CLO) and Programme Outcomes (PO)

Course Learning Outcomes: upon successful completion of the course, students will be able to:	**Suitable Bloom Taxonomy Relevant to the CLOs**	**POs**	**Assessment Tools**
Generate block diagram analysis to characterize communication systems, including modulation and demodulation techniques, to design and simulate practical communication systems using software tools.	5	1, 4, 5, 6	Practical Reports
Use transfer function models and feedback system representation to analyze and design control systems, employing root locus, Bode, Nyquist, and Nichols plots to assess stability and performance characteristics.	3	1, 2, 3, 6, 8, 11	Practical Reports
Evaluate diverse electrical energy generation methods and power system layouts, utilizing per unit representation and steady-state analysis techniques to assess system performance and reliability.	6	1, 2, 3, 7, 9, 11	Practical Reports
Design and simulate transmission line systems, considering various parameters and fault scenarios, and employ network reduction techniques to analyze fault conditions and ensure system protection.	5	1, 2, 3, 6, 7, 8	Practical Reports
Design multiplexing techniques such as FDM, TDM, and WDM, along with shift keying methods, to optimize bandwidth utilization and improve data transmission efficiency in communication systems.	5	1, 4, 5, 6	Practical Reports
Combine control system synthesis principles with electrical power system analysis to optimize system stability and performance, employing frequency response analysis to assess closed-loop performance.	5	1, 2, 3, 6, 8, 11	Practical Reports

f) Mapping of CLOs to relevant POs

Course Learning Outcomes	Programme Outcomes (POs):											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Generate block diagram analysis to characterize communication systems, including modulation and demodulation techniques, to design and simulate practical communication systems using software tools.	**3**			**3**	**2**	**2**						
Use transfer function models and feedback system representation to analyze and design control systems, employing root locus, Bode, Nyquist, and Nichols plots to assess stability and performance characteristics.	**3**	**3**	**3**			**2**		**3**			**2**	
Evaluate diverse electrical energy generation methods and power system layouts, utilizing per unit representation and steady-state analysis techniques to assess system performance and reliability.	**3**	**3**	**3**				**3**		**3**		**3**	
Design and simulate transmission line systems, considering various parameters and fault scenarios, and employ network reduction techniques to analyze fault conditions and ensure system protection.	**3**	**3**	**3**			**3**	**3**	**3**				
Design multiplexing techniques such as FDM, TDM, and WDM, along with shift keying methods, to optimize bandwidth utilization and improve data transmission efficiency in communication systems.	**3**			**3**	**3**	**3**						
Combine control system synthesis principles with electrical power system analysis to optimize system stability and performance, employing frequency response analysis to assess closed-loop performance.	**3**	**3**	**3**			**3**		**3**			**3**	

Keys: 1 = Slightly related, 2 = Moderately related, 3= Highly related

g) Expectations of Students

a. Attend at least 11 practical sessions

b. Submit Practical Report after every practical

c. Design and implement one mini project

h) Methods of Lecture Delivery/Teaching Aids

Lecture Delivery Methods

Practical instruction in the lab by the technologist as supervised by the attending lecturer

Teaching Aids

Laboratory Equipment, Videos, and Illustrations

i) Course Content or Outline

Topics	Weeks
Power protection circuit	1
Renewable energy system	2 - 3
Characteristics of fibre optic	3
The relationship between the input signal and received signal in a 650nm fibre optic analogue and digital links.	4 – 5
The intensity modulation of the analogue and digital signals, transmit it over a fibre optic cable and demodulate the same signal at the receiver end to retrieve the original signal.	6 – 7
Measurement of optical power using optical power meter	8 – 9
Frequency modulation (FM)	10
Voice communications through a fibre optic cable using am	11 – 12
Pulse width modulation	13
Revision & Examination	14-15

j) Method of Grading Continuous Assessment

Practical Report: 70%

Mini project: 30%

k) Tutorials

None

l) Term Paper and Assignments

One Mini project relating to Electronic, Control, Communication and Power Principles

m) Contemporary Issues and Industrial Relevance

Contemporary Issues:

- Integration of Renewable Energy Sources: As more renewable energy sources, like solar and wind power, are added to the grid, it's more important than ever to make sure that protection systems are effective and work well. Students need to know how to change current safety systems to work with the intermittent and changing nature of renewable energy sources.
- How to Keep Power Systems Safe Online: Critical infrastructure is more likely to be attacked by hackers as power systems become more digital and linked. It is very important to come up with security plans that keep cyber threats at bay and keep the power grid safe and available.

Industrial Relevance:

- Need for Skilled Protection Engineers: Power companies and engineering firms need skilled engineers who can plan, set up, and keep up with power system protection plans. In the power system protection field, graduates with real-world knowledge are in high demand.

- Regulatory Compliance and Standards: It is very important to follow industry standards and regulatory rules for protecting power systems. To make sure that protection plans follow the law and safety rules, businesses need engineers who know about standards like IEEE, IEC, and NERC.

BOWEN UNIVERSITY, IWO

Faculty of Engineering

Department of Electrical/Electronic Engineering

Course Code: EEE 429 **Course** Students Industrial Work Experience Scheme

Semester: Second **Credit Hours**: 2

Contact Hours: Practicals - 2 hours lectures per Week

Location: Engineering Workshop **Lecturer(s)**: All Staff

Textbooks and other Materials:

1. *Entrepreneurship for Engineers* by Mark J. DeLong (2020)

The Industrial Training Fund (ITF) publishes guidelines and information booklets on SIWES which can be found on their website https://www.siwes.itf.gov.ng/Identity/LandingPage/siwes.

a) Course Overview and description

The course is structured in such a way to foster in-depth understanding of Electrical services and its relation to industries. Issues of Safety and Regulations of Electrical installations were given an in-depth consideration.

b) Pre-requisites: Nil

c) Co-requisite(s): Nil

d) Role in Curriculum: Core

e) Course Learning Outcome (CLO) and Programme Outcomes (PO)

Course Learning Outcomes: upon successful completion of the course, students will be able to:	**Suitable Bloom Taxonomy Relevant to the CLOs**	**POs**	**Assessment Tools**
Understand the establishment's services, products, and goals;	2	1, 2, 12	Practical and Oral Exams
Outline the roles of available departments and the contribution of their own department to the operation of the establishment;	4	1, 2, 8	Practical and Oral Exams
Develop confidence to work individually and team spirit to work with others in their establishment;	5	1, 3, 4, 11	Practical and Oral Exams
Compare contents learnt in the curriculum with experience in the field, and learn to apply industry standard tools to problem-solving;	4	1, 3, 10, 12	Practical and Oral Exams
Justify and present their work experience effectively through written and oral communication;	6	5, 7, 9, 12	Practical and Oral Exams
Evaluate the importance of self-learning and development.	6	8, 12	Practical and Oral Exams

f) Mapping of CLOs to relevant POs

Course Learning Outcomes	**Programme Outcomes (POs):**											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Understand the establishment's services, products, and goals;	**3**	**2**										**1**
Outline the roles of available departments and the contribution of their own department to the operation of the establishment;	**3**	**3**						**2**				
Develop confidence to work individually and team spirit to work with others in their establishment;	**3**		**2**	**2**							**3**	
Compare contents learnt in the curriculum with experience in the field, and learn to apply industry standard tools to problem-solving;	**3**		**3**							**3**		**2**
Justify and present their work experience effectively through written and oral communication;					**3**		**3**		**2**			**3**
Evaluate the importance of self-learning and development.								**3**				**3**

Keys: 1 = Slightly related, 2 = Moderately related, 3= Highly related

g) Expectations of Students

a. Attend 30 hours of Workshop practice per week

b. Turn in assignments and projects as considered suitable by the tutors

c. Complete continuous assessment which involves mid-semester test

d. Complete a 2-hour comprehensive final examination at the end of the programme.

h) Methods of Lecture Delivery/Teaching Aids

Lecture Delivery Methods

Industrial Training

i) Course Content or Outline

Topics	**Weeks**
• Students work presentation and defense	15

j) Method of Grading Continuous Assessment

Students work presentation and defense.

k) Tutorials

Workshop/laboratory practice

l) Term Paper and Assignments

Assignments

m) Contemporary Issues and Industrial Relevance

Students Industrial Work Experience (SIWES) programs offer a valuable bridge between academic learning and real-world application. However, contemporary issues and the ever-evolving industrial landscape can create a gap between the programmes goals and its effectiveness. Here is a breakdown of some key aspects to consider:

Contemporary Issues:

- Misaligned Curriculum: Academic coursework may not fully reflect the latest industry trends and technologies. This can leave students unprepared for the practical skills needed during SIWES placements.
- Lack of Industry Collaboration: Universities and Faculty might not have strong partnerships with relevant industries. This can lead to placements that are generic or don't offer students exposure to cutting-edge practices.
- Focus on Quantity over Quality: Sometimes, programs prioritize placing a high number of students rather than ensuring quality placements that offer meaningful learning opportunities.
- Stipend and Welfare Concerns: Students may not receive adequate financial support or proper safety and health considerations during their placements.

Industrial Relevance:

- Emerging Technologies: Industries are constantly adopting new technologies like AI, automation, and big data. SIWES programs need to find ways to integrate training on these areas to prepare students for future jobs.
- Soft Skills Gap: While technical skills are important, industries increasingly value soft skills like communication, teamwork, and problem-solving. SIWES programs should incorporate opportunities to develop these skills during placements.
- Shifting Workplace Culture: The rise of remote work and flexible work arrangements requires students to be adaptable and comfortable with new work styles. SIWES placements should reflect these evolving trends.

Bridging the Gap:

- Curriculum Updates: Educational institutions need to regularly update their curriculum to reflect industry needs. Collaboration with industry professionals during curriculum development is crucial.
- Industry Partnerships: Stronger partnerships between universities and industries can lead to more relevant placements that offer real-world problem-solving opportunities.
- Mentorship Programs: Providing students with mentors from their placement companies can ensure proper guidance and foster a more enriching experience.
- Skills-based Placements: Matching students' skills and interests with specific industry needs can lead to more focused and relevant work experiences.
- By addressing these contemporary issues and ensuring industrial relevance, SIWES programs can become even more valuable in preparing students for successful careers in the ever-changing job market.

BOWEN UNIVERSITY, IWO
Faculty of Engineering
Department of Electrical/Electronic Engineering

Course Code: EEE 501

Course Title: Digital Signal Processing

Semester: First

Credit Hours: 2 hours

Contact Hours: Lecture - Two hours of lectures per Week

Location: New Horizon

Lecturer(s): Dr. D. O. Akande

Textbooks and other Materials:

1. Introduction to Digital Signal Processing by Bob Meddins, (2000), Newnes.

a) Course Overview and description

This course is structured into the analysis and manipulation of digital signals. It explores powerful tools like the z-transform and the Fast Fourier Transform to understand the frequency content of digital signals. Further, the course delves into filter design techniques for shaping signals, enabling the extraction of desired frequencies or removal of unwanted noise. Finally, it explores the practical implementation of digital filters in hardware and software, along with basic image processing concepts, equipping you for various signal processing applications.

b) Pre-requisites: Nil

c) Co-requisite(s): Nil

d) Role in Curriculum: Compulsory

e) Course Learning Outcome (CLO) and Programme Outcomes (PO)

Course Learning Outcomes: upon successful completion of the course, students will be able to:	**Suitable Bloom Taxonomy Relevant to the CLOs**	**POs**	**Assessment Tools**
Differentiate the concept of network synthesis and realization.	4	1	Assignment, quizzes and Exams
Compare analytical tools such as Fourier transforms, discrete Fourier transforms, fast Fourier transforms, and Z-transforms required for solving network theory problems	4	2	Assignment, quizzes and Exams
Evaluate spectra of discrete-time signals and their applications in filters	6	2	Assignment, quizzes and Exams
Design different types of digital filters and their transfer function.	5	4, 5	Assignment, quizzes and Exams
Design and realize various digital filters for digital signal processing in both hardware and software	5	4, 5, 12	Assignment, quizzes and Exams
Explain the applications of DSP in image processing and analysis.	2	1, 5, 6, 8	Assignment, quizzes and Exams

f) Mapping of CLOs to relevant POs

Course Learning Outcomes	Programme Outcomes											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Differentiate the concept of network synthesis and realization.	**3**											
Compare analytical tools such as Fourier transforms, discrete Fourier transforms, fast Fourier transforms, and Z-transforms required for solving network theory problems		**3**										
Evaluate spectra of discrete-time signals and their applications in filters		**3**										
Design different types of digital filters and their transfer function.				**3**	**3**							
Design and realize various digital filters for digital signal processing in both hardware and software				**3**	**3**							**1**
Explain the applications of DSP in image processing and analysis.	**3**				**3**	**3**		**2**				

Keys: 1 = Slightly related, 2 = Moderately related, 3 = Highly related

g) Expectations of Students

a. Attend 2 hours of lectures per week

b. Turn in assignments and projects as considered suitable by the tutor

c. Complete continuous assessment which involves mid-semester test

d. Complete a 2-hour comprehensive final examination at the end of the semester.

h) Methods of Lecture Delivery/Teaching Aids

Lecture Delivery Methods

Educator-Student Interaction (Discussion, practice exercises, case study and simulation method)

Teaching Aids

Visual Aids (Use of PowerPoint slides, Lecture templates-handouts)

i) Course Content or Outline

Topics	Weeks
Discrete-Time Signals and Analysis • Introduction to Discrete-Time Signals - Properties, sampling, quantization. • The Z-Transform - Definition, properties, applications in analyzing discrete systems. • Poles and Zeros in the Z-Domain - Stability analysis and frequency response interpretation.	1 - 3
Frequency Domain Analysis • Discrete Fourier Transform (DFT) - Properties, applications in frequency analysis of discrete signals. • Fast Fourier Transform (FFT) - Algorithms and computational efficiency compared to DFT.	4 - 5
Filter Design Fundamentals • Approximation Problem in Network Theory - Designing filters to meet desired frequency response characteristics. • Filter Design Techniques - Introduction to Butterworth, Chebyshev, and Elliptic filters.	6 - 7
Spectral Transforms and Filter Synthesis • Spectral Transforms - Properties and applications (bilateral, unilateral). • High-Pass and Band-Pass Filter Design using Spectral Transforms - Leveraging spectral transforms to achieve specific filtering needs.	8 - 9
Digital Filters • Digital Filter Fundamentals - Definition of digital filters, transfer function concept. • Recursive (IIR) and Non-Recursive (FIR) Filters - Design, analysis, and applications of each type. • Computer-Aided Design (CAD) for Filter Synthesis - Utilizing software tools for efficient filter design. • Hardware and Software Realization - Exploring the challenges and techniques for implementing digital filters in hardware or software.	10 - 12
Introduction to Image Processing • Basic Image Processing Concepts - Gaining a foundational understanding of image enhancement, filtering, and restoration.	12 - 13
Lecture free week	13
Revision & Examination	14 - 15

j) Method of Grading Continuous Assessment

Continuous Assessment (Assignment): 10%
Continuous Assessment Test: 20%
End of Semester Examination: 70%

k) Tutorials

Tutorial will be offered at the end of each module.

l) Term Paper and Assignments

The term paper and assignments address problem solving which involve applying powerful tools and concepts in the designing and implementation of digital filters in software or hardware, potentially with applications in image processing.

m) Contemporary Issues and Industrial Relevance

This course equips the students with the skills to analyze and manipulate digital signals using powerful tools like the Z-transform and Fast Fourier Transform. Students learn to design and implement digital filters in hardware and software for various applications, including noise reduction and signal extraction, while gaining foundational knowledge in image processing.

BOWEN UNIVERSITY, IWO
Faculty of Engineering
Department of Electrical/Electronic Engineering

Course Code: EEE 502 **Course Title:** Digital and Modern Control Systems
Semester: Second **Credit Hours**:2 hours
Contact Hours: Lecture - Two hours lectures per Week
Location: New Horizon Studio 4 **Lecturer(s)**: Dr. D. O. Akande
Textbooks and other Materials:

1. Modern Digital Control Systems by Raymond G. Jacquot, (1995), 2nd edition, Taylor &. Francis Group.

a) Course Overview and description

This course bridges the gap between digital systems and control engineering. It also explores how to design digital controllers using concepts like sampling and Z-transform for analyzing system behavior. Additionally, the course introduces advanced control techniques like state-space analysis and explores emerging areas like neural networks, fuzzy control, and mechatronics, preparing students for the future of automated systems.

b) Pre-requisites: Nil

c) Co-requisite(s): Nil

d) Role in Curriculum: Core

e) Course Learning Outcome (CLO) and Programme Outcomes (PO)

Course Learning Outcomes: upon successful completion of the course, students will be able to:	**Suitable Bloom Taxonomy Relevant to the CLOs**	**POs**	**Assessment Tools**
Explain the fundamental concepts of digital control and state variable of dynamic systems.	3	1, 2, 6, 12	Assignment, quizzes and Exams
Analyzing the state vector differential equations using mathematical tools.	4	1, 2, 4, 6, 12	Assignment, quizzes and Exams
Evaluate the characteristics of system response and stability.	5	1, 2, 3, 6, 8	Assignment, quizzes and Exams
Design and evaluate the application of 3-terms PID controllers.	6	1, 2, 3, 4, 6, 8	Assignment, quizzes and Exams
Analyze the basic principles of neural network and fuzzy control system to digital control systems; and	4	1, 2, 6	Assignment, quizzes and Exams
Outline the basics of mechatronics and robotics.	6	1, 6, 12	Assignment, quizzes and Exams
Apply simulation tools like MATLAB/Simulink to design and analyze digital control systems.	3	5, 6, 10, 11	Assignment, quizzes and Exams

f) Mapping of CLOs to relevant POs

Course Learning Outcomes	**Programme Outcomes**											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Explain the fundamental concepts of digital control and state variable of dynamic systems.	**3**	**3**				**3**						**3**
Analyzing the state vector differential equations using mathematical tools.	**3**	**3**		**3**		**3**						**3**
Evaluate the characteristics of system response and stability.	**3**	**3**	**3**			**3**		**3**				
Design and evaluate the application of 3-terms PID controllers.	**3**	**2**	**3**	**2**		**3**		**1**				
Analyze the basic principles of neural network and fuzzy control system to digital control systems; and	**3**				**3**						**1**	
Outline the basics of mechatronics and robotics.					**3**	**2**				**3**	**3**	

Keys: 1 = Slightly related, 2 = Moderately related, 3 = Highly related

g) Expectations of Students

a. Attend 2 hours of lectures per week
b. Turn in assignments and projects as considered suitable by the tutors
c. Complete continuous assessment which involves mid-semester test
d. Complete a 2-hour comprehensive final examination at the end of the semester.

h) Methods of Lecture Delivery/Teaching Aids

Lecture Delivery Methods

Educator-Student Interaction (Discussion, presentation, simulation method)

Teaching Aids

Visual Aids (Use of PowerPoint slides, Lecture templates-handouts)

i) Course Content or Outline

Topics	Weeks
Digital Control • Definition and comparison with Analog Control Systems • Advantages of Digital Control (precision, flexibility, etc.) • Components of a Digital Control System (sensors, A/D converters, controllers, D/A converters, actuators) • Applications of Digital Control (industrial automation, robotics, signal processing)	1 - 2
Sampling and Z-Transform • Sampling Theory (Nyquist-Shannon theorem) • Discrete-time signals vs. Continuous-time signals • Sampling process and aliasing • Z-transform: definition, properties, applications in analyzing discrete systems.	3 - 4
Zero-Order-Hold • Discretization of continuous-time control systems • Zero-order-hold (ZOH) method for approximating continuous signals • Impact of ZOH on system behavior • Analysis of ZOH systems using Z-transform	5 - 6
Stability Analysis • Importance of stability in control systems • Stability criteria for digital control systems (Jury's stability test, Routh-Hurwitz method) • Root locus analysis for digital systems using Z-transform.	7 - 8
State Space Analysis • Introduction to State Variables. • Representing dynamic systems with state equations. • Formulation of state vector differential equations. • Solution of state equations using Laplace transform or state transition matrix. • Eigenvalues and eigenvectors: their role in system response and stability.	9 - 10
Advanced Topics in Digital Control Systems • Finite Word Length Effects: quantization errors and their impact on control performance. • Digital PID Controller Design: implementing proportional, integral, and derivative control in the digital domain. • Introduction to Neural Networks: basic concepts and potential applications in control systems • Introduction to Fuzzy Control Systems: using fuzzy logic for decision-making in control. • Mechatronics and Robotics: integration of mechanics, Electronic, and control systems for intelligent machines.	11 - 13

Lecture free week	13
Revision & Examination	14 - 15

j) Method of Grading Continuous Assessment

Continuous Assessment (Assignment): 10%
Continuous Assessment Test: 20%
End of Semester Examination: 70%

k) Tutorials

Tutorial will be offered at the end of each module.

l) Term Paper and Assignments

The term paper explores the areas of applications of digital PID control and emerging fields like neural networks and fuzzy logic in control systems while the assignments cover the core concepts of sampling, z-transform, stability assessment and state-space analysis of digital control systems.

m) Contemporary Issues and Industrial Relevance

This course equips you with the tools to design and analyze digital control systems, crucial for modern automation. Students explore fundamental techniques like sampling and state-space analysis, alongside emerging areas like neural networks and fuzzy control, preparing them for the future of intelligent machines and robots.

BOWEN UNIVERSITY, IWO

Faculty of Engineering

Department of Electrical/Electronic Engineering

Course Number: EEE 503 **Course Title:** Electronic/Electrical Instrumentation

Semester: First **Credit Hours**: 30 hours

Contact Hours: One (Two hours) lectures per Week

Location: New Horizon **Lecturer(s)**: Engr. Dr. Isaac A. Ojedokun

Textbooks and other Materials:

1. William David Cooper: "Electronic Instrumentation and Measurement Techniques"
2. Helfrick and Cooper: "Modern Electronic Instrumentation and Measurement Techniques"
3. Roman Malaric: "Instrumentation and Measurement in Electrical Engineering"
4. A.K. Sawhney: "Electrical and Electronic Measurements and Instrumentation"
5. Slawomir Tumanski: " Principles of Electrical Measurement"

a) Course Overview and description

This course provides an in-depth exploration of advanced electronic measurement techniques and equipment design principles. Students will gain practical knowledge and skills in utilizing various measuring techniques and electronic devices for accurate data acquisition and analysis. Topics such as basic electrical and electronic measuring techniques, including the use of transducers for electrical and industrial applications are discuss are to be discussed. Opto-electronic systems and digital electronic measuring systems, with a focus on data logging and conversion techniques are to be introduced. It deals with the design considerations for electronic equipment, including specifications such as environmental factors (e.g., vibration, humidity, temperature) and safety measures. Reliability testing and strategies for enhancing reliability, including redundancy and duplication of least reliable parts are to be mentioned passively. Ergonomics, aesthetics, and economics will be discussed in the context of electronic equipment design, emphasizing user experience and cost-effectiveness. Miniature and micro-miniature construction techniques using printed circuit board (PCB) technology will be introduced. Through hands-on exercises and projects, students will develop practical skills in designing and prototyping electronic equipment using PCBs. Overall, this course equips students with the knowledge and skills needed to design, analyze, and optimize electronic measurement systems and equipment, considering factors such as reliability, safety, ergonomics, aesthetics, and economics.

b) Pre-requisites: Nil

c) Co-requisite(s): Nil

d) Role in Curriculum: Core

e) Course Learning Outcome (CLO) and Programme Outcomes (PO)

Course Learning Outcomes: Upon successful completion of the course, students will be able to:	**Suitable Bloom Taxonomy Relevant to the CLOs**	**POs**	**Assessment Tools**
Demonstrate proficiency in basic electrical and electronic measuring techniques;	3	1, 5, 10	Homework, quizzes and Exams
Outline the principles and applications of electrical and industrial transducers;	4	1, 2, 5, 6	Homework, quizzes and Exams
Analyze and design Opto-Electronic systems;	4	1, 2, 3, 5, 10	Homework, quizzes and Exams
Evaluate digital electronic measuring systems;	6	1, 3, 5, 10, 11	Homework, quizzes and Exams
Evaluate the design specifications and reliability of electronic equipment;	6	2, 3, 4, 5, 11	Homework, quizzes and Exams
Develop strategies for redundancy and reliability enhancement and	5	3, 4, 5, 11	Homework, quizzes and Exams
Apply principles of ergonomics, aesthetics, and economics in electronic equipment design	3	3, 6, 11	Homework, quizzes and Exams

f) Mapping of CLOs to relevant POs

Course Learning Outcomes	Programme Outcomes											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Demonstrate proficiency in basic electrical and electronic measuring techniques;	**3**				**2**					**3**		
Outline the principles and applications of electrical and industrial transducers;	**2**	**3**			**2**	**1**						
Analyze and design Opto-Electronic systems;	**3**	**3**	**2**		**3**					**3**		
Evaluate digital electronic measuring systems;	**3**		**3**		**2**					**1**	**2**	
Evaluate the design specifications and reliability of electronic equipment;		**3**	**2**	**2**	**3**						**3**	
Develop strategies for redundancy and reliability enhancement and			**3**	**3**	**2**						**3**	
Apply principles of ergonomics, aesthetics, and economics in electronic equipment design			**2**			**3**					**2**	

Keys: 1 = Slightly related, 2 = Moderately related, 3= Highly related

g) Expectations of Students

1. Attend 2 hours of lectures per week
2. Turn in assignments and projects as instructed by the tutors
3. Complete continuous assessment, which involves mid-semester test and others
4. Complete a 2-hour comprehensive final examination at the end of the semester.

h) Methods of Lecture Delivery/Teaching Aids

Lecture Delivery Methods

Educator-Student Interaction (Discussion method) Video Tutorials Electrical

Teaching Aids

Visual Aids (Use of PowerPoint slides, Lecture templates-handouts, Laboratory work)

i) Course Content or Outline

Topics	Weeks
Introduction to Electrical and Electronic Measuring Techniques: basic electrical parameters (voltage, current, resistance), Introduction to measuring instruments and techniques, Laboratory session: Hands-on practice with multi-meters and oscilloscopes. **Electrical Transducers and Measurement Systems:** Principles of electrical transducers, Types and applications of industrial measurement systems, Case studies and examples of industrial transducers.	1-2
Opto-Electronic Systems: Introduction to opto-electronic systems, Principles of operation of optical sensors, Design considerations for opto-electronic systems. **Digital Electronic Measuring Systems,** Introduction to digital electronic measuring systems, A/D and D/A conversion techniques, Case studies and applications of digital measuring systems.	3-4
Data Logging and Conversion: Principles of data logging and data acquisition systems, Types and applications of A/D and D/A converters Laboratory session: Setting up data logging systems. **Design Specifications and Environmental Factors:** Understanding design specifications for electronic equipment, Considerations for environmental factors such as vibration, humidity, and temperature, Case studies and examples of design challenges.	5-6
Tolerance, Safety Measures, and Reliability: Importance of tolerance, safety measures, and reliability in electronic equipment design**,** Techniques for ensuring reliability and safety, Reliability testing methods and procedures. **Duplication and Redundancy:** Principles of duplication and redundancy in electronic systems, Strategies for implementing redundancy and standby mechanisms, Case studies and examples of redundancy in practice.	7
Ergonomics, Aesthetics, and Economics: Understanding the role of ergonomics, aesthetics, and economics in electronic equipment design, Design principles for user-friendly interfaces and visually appealing products Economic considerations in product design and manufacturing. **Miniature and Micro-miniature Construction:** Introduction to miniature and micro-miniature construction techniques, Design considerations for printed circuit boards (PCBs), Laboratory session: PCB design and fabrication.	8-9
Project Work, Presentation and Evaluation: Students work on a project related to electronic equipment design, Apply concepts learned throughout the course to design and prototype a functional electronic device, Students are to present their project work to the class for peer evaluation. **Tutorials.**	10-12
Lecture free week	13
Revision & Examination	14 - 15

j) Method of Grading Continuous Assessment

Continuous Assessment (Assignments): 10%

Continuous Assessment Test: 20%

End of theSsemester Exam: 70%

k) Tutorials

Tutorials were given at the end of each module.

l) Term Paper and Assignments

The term paper will explore fundamental electrical and electronic measuring techniques in detail, with an emphasis on design specifications, reliability considerations, and environmental factors that affect electronic equipment. Examples of these techniques include digital electronic measuring systems, data logging, and applications involving Analog to Digital and Digital to A conversion. In order to use measuring systems, transducers, and electronic equipment design, the assignments will comprise practical exercises and problem-solving tasks that incorporate ideas like ergonomics, redundancy methods, and micro fabrication utilising printed circuit boards.

m) Contemporary Issues and Industrial Relevance

This course's material addresses current concerns and has industrial significance. It integrates sophisticated measurement techniques, like data logging and digital electronic measuring systems, with an emphasis on precision, dependability, and environmental considerations. In order to satisfy the expectations of the current industry for small and effective electronic systems, tolerance, safety precautions, ergonomics, and cost-effectiveness are also prioritised in the design of electronic equipment. Miniaturizations and micro miniature construction techniques are used and has substantial industrial importance for the design of contemporary electronic measuring systems.

BOWEN UNIVERSITY, IWO
Faculty of Engineering
Department of Electrical/Electronic Engineering

Course Number: EEE 504
Course Title: Reliability and Maintainability of Systems
Semester: Second
Credit Hours: 2 hours
Contact Hours: Lecture - Two hours lectures per Week
Location: New Horizon
Lecturer(s): Prof. O. A. Komolafe & Mr. J. O. Babalola

Textbooks and other Materials:

1. "Introduction to Reliability Engineering" by E.E. Lewis
2. "Maintainability, Availability, and Operational Readiness Engineering Handbook" by Dhillon, B.S
3. "Reliability Engineering" by Elsayed A. Elsayed and Benjamin S. Blanchard

a) Course Overview and description

The course is structured in such a way to foster in-depth understanding of applications of reliability and maintainability principles in the design and operation of Electrical systems. Issues of Fault detection and outage minimization were considered.

b) Pre-requisites:

c) Co-requisite(s): Nil

d) Role in Curriculum: Core

e) Course Learning Outcome (CLO) and Programme Outcomes (PO)

Course Learning Outcomes: upon successful completion of the course, students will be able to:	**Suitable Bloom Taxonomy Relevant to the CLOs**	**POs**	**Assessment Tools**
Outline systems reliability specifications and metrics in the context of power systems, electronic components, and communication equipment, applying mathematical and statistical techniques for assessing system reliability.	4	1, 2, 4, 5	Homework, quizzes and Exams
Develop basic maintenance procedures for computer and digital communication systems, utilizing fault troubleshooting techniques to diagnose and rectify system failures effectively	5	3, 4, 6, 9	Homework, quizzes and Exams
Assess and optimize Quality of Service (QoS) and data availability in communication and power networks, employing quality control techniques and designing for higher reliability and fault tolerance.	6	2, 3, 4, 7, 11	Homework, quizzes and Exams
Apply software reliability metrics and specifications to ensure the reliability and safety of software systems, implementing fault avoidance and fault tolerance strategies through effective programming practices.	3	1, 2, 4, 5, 8	Homework, quizzes and Exams
Develop strategies for ensuring quality and reliability throughout the software development lifecycle, including verification and validation processes, measurement tracking, total quality management, and risk management techniques.	5	2, 4, 6, 12	Homework, quizzes and Exams

f) Mapping of CLOs to relevant POs

Course Learning Outcomes	**Programme Outcomes**											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Outline systems reliability specifications and metrics in the context of power systems, electronic components, and communication equipment, applying mathematical and statistical techniques for assessing system reliability.	**3**	**3**		**3**	**3**							
Develop basic maintenance procedures for computer and digital communication systems, utilizing fault troubleshooting techniques to diagnose and rectify system failures effectively			**2**	**2**		**2**			**2**			
Assess and optimize Quality of Service (QoS) and data availability in communication and power networks, employing quality control techniques and designing for higher reliability and fault tolerance.		**3**	**3**	**3**			**3**				**3**	
Apply software reliability metrics and specifications to ensure the reliability and safety of software systems, implementing fault avoidance and fault tolerance strategies through effective programming practices.	**3**	**3**		**3**	**3**			**3**				
Develop strategies for ensuring quality and reliability throughout the software development lifecycle, including verification and validation processes, measurement tracking, total quality management, and risk management techniques.						**3**		**3**	**3**	**3**		**3**
Outline systems reliability specifications and metrics in the context of power systems, electronic components, and		**2**		**2**		**2**						**2**

communication equipment, applying mathematical and statistical techniques for assessing system reliability.												

Keys: 1 = Slightly related, 2 = Moderately related, 3= Highly related

g) Expectations of Students

a. Attend 2 hours of lectures per week

b. Turn in assignments and projects as considered suitable by the tutors

c. Complete continuous assessment which involves mid-semester test

d. Complete a 2-hour comprehensive final examination at the end of the semester.

h) Methods of Lecture Delivery/Teaching Aids

Lecture Delivery Methods

Educator-Student Interaction (Discussion method, Interactive method, flipped classroom)

Video Tutorials Electrical systems.

Teaching Aids

Visual Aids (Use of PowerPoint slides, Lecture templates-handouts)

i) Course Content or Outline

Topics	Weeks
• Overview of reliability and maintainability concepts • Importance of reliability and maintainability in engineering • Reliability metrics and measurements • Introduction to reliability specification and standards	1 - 2
• Failure analysis techniques • Reliability prediction models • Mean time between failures (MTBF) calculations • Failure modes and effects analysis (FMEA)	3 - 4
• Introduction to maintainability engineering • Maintainability metrics and measurements • Design for maintainability principles • System availability calculations	5 - 6
• Reliability testing methods (e.g., accelerated life testing, reliability growth testing) • Statistical analysis of reliability data • Reliability block diagrams and system reliability modeling • Reliability-centered maintenance (RCM) principles	7 - 8
i. Principles of fault tolerance ii. Redundancy techniques (e.g., standby redundancy, active redundancy) iii. Reliability of redundant systems iv. Fault-tolerant design considerations	9 - 10
• Introduction to software reliability engineering • Software reliability metrics and measurements • Software fault tolerance and error detection techniques • Software quality assurance practices and standards • Application of reliability and maintainability principles to case studies and real-world examples	11-12
Lecture free week	13
Revision & Examination	14-15

j) Method of Grading Continuous Assessment

Continuous Assessment (Assignments) - 20%
Continuous Assessment Test - 10%
End of Semester Examination - 70%

k) Tutorials

Tutorial will be offered at the end of each module.

l) Term Paper and Assignments

Term Paper

A well-structured term paper (10-15 pages) with proper referencing including relevant diagrams and figures calculations to support their explanation would be required of them at the beginning of module 3 (beginning of week 5) and expected to be turned in end of the module 5 (End of week 10).

Assignments:

Three major assignments would be given on reliability and maintainability in engineering design, analyzing a real-world case study where a lack of reliability and maintainability lead to significant consequences

m) Contemporary Issues and Industrial Relevance

- The increasing integration of complex technologies and systems in various industries poses challenges for ensuring reliability and maintainability, highlighting the need for advanced methodologies and strategies to address emerging issues.
- With the rise of Industry 4.0 and the adoption of digitalization and automation, there's a growing emphasis on predictive maintenance and reliability-centered approaches to optimize asset performance and minimize unplanned downtime.

Industrial Relevance:

- Reliability and maintainability engineering play a crucial role in sectors such as aerospace, automotive, and telecommunications, where product reliability directly impacts safety, customer satisfaction, and brand reputation.
- In manufacturing, energy, and healthcare industries, effective reliability and maintainability practices are essential for maximizing operational efficiency, minimizing production disruptions, and ensuring compliance with regulatory standards.

BOWEN UNIVERSITY, IWO
Faculty of Engineering
Department of Electrical/Electronic Engineering

Course Code: EEE 505
Course Title: Broadcasting and Internet Technology
Semester: First
Credit Hours: 2 hours
Contact Hours: Lecture - Two hours of lectures per Week
Location: New Horizon
Lecturer(s): Dr. S. I. Ojo
Textbooks and other Materials:

1. Broadcasting, Cable, the Internet, and Beyond: An Introduction to Modern Electronic Media 7th Edition by Joseph Dominick
2. Multimedia Internet Broadcasting: Quality, Technology and Interface (Computer Communications and Networks) Softcover reprint of the original 1st ed. 2001 Edition by Andy Sloane and Dave Lawrence.

a) Course Overview and description

The course covers various aspects of broadcasting systems, including studio design, regulatory frameworks, frequency spectrum management, and antenna installation. It also delves into digital broadcasting technologies, internet broadcasting principles, and internet architecture, providing a comprehensive overview of the field and its modern applications.

b) Pre-requisites: Nil

c) Co-requisite(s): Nil

d) Role in Curriculum: Core

e) Course Learning Outcome (CLO) and Programme Outcomes (PO)

Course Learning Outcomes: upon successful completion of the course, students will be able to:	**Suitable Bloom Taxonomy Relevant to the CLOs**	**POs**	**Assessment Tools**
Outline the fundamentals of Broadcasting	4	3	Assignment, quizzes and Exams
Apply Knowledge of the Frequency Spectrum and understand Signal Transmission and Reception	3	1, 3	Assignment, quizzes and Exams
Compare broadcasting standard and design broadcasting infrastructure	4	2, 3	Assignment, quizzes and Exams
Assess the principle of Television broadcasting systems and explore internet technologies	6	2, 5	Assignment, quizzes and Exams

f) Mapping of CLOs to relevant POs

Course Learning Outcomes	**Programme Outcomes**											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Outline the fundamentals of Broadcasting			**3**									
Apply Knowledge of the Frequency Spectrum and understand Signal Transmission and Reception	**3**		**3**									
Compare broadcasting standard and design broadcasting infrastructure		**3**	**3**									
Assess the principle of Television broadcasting systems and explore internet technologies			**2**		**3**							

Keys: 1 = slightly related, 2 = moderately related, 3 = highly related

g) Expectations of Students

a. Attend 2 hours of lectures per week

b. Turn in assignments considered suitable by the tutors

c. Complete continuous assessment which involves mid-semester test

d. Complete a $2^1/_2$-hour comprehensive final examination at the end of the semester.

h) Methods of Lecture Delivery/Teaching Aids

Lecture Delivery Methods

Educator-Student Interaction (Discussion method and analogies)

Teaching Aids

Visual Aids (Use of Power Point slides, Lecture templates-handouts)

i) Course Content or Outline

Topics	Weeks
Element of broadcasting system: • Studio (Design, acoustic, and equipment) • Broadcasting regulations • Frequency spectrum (allocation, licensing and regulatory bodies)	1 - 2
Design, configuration, and services of TVs: • Design, configuration, and services of CATV systems • Design, configuration, and services of MATV systems • Design, configuration, and services of MMDS systems • Difference between CATV, MATV, MMDS systems	3 - 4
Multipath propagation problems: • Polarization, field strength, and footprint. • Transmitter power rating, beam width, • Interference and minimum separation • Methods of solving multipath propagation problems	5 - 6
Frequency spectrum management of digital and analogue broadcasting: • Cognitive radio (Spectrum shearing system) • Antenna design and installation for radio and television, • Antenna design and installation for satellite. • Antenna support, Mast and Tower,	7-8
TV broadcast band and specification: • Transmitter and receiver block diagrams of TV (Black and White TV, and Colour TV). • Introduction to digital broadcasting. • HDTV. Digital television/Monitor set: LCD, and Plasma technology	9 -11
Internet Technology: • Internet, definition and services. • Internet architecture, OSI layers, TCP/IP, Internet addressing, IPv4, IPv6. • Internet broadcasting: principles, components, standards, and applications	12-13

j) Method of Grading Continuous Assessment

Continuous Assessment (Assignment): 10%

Continuous Assessment Test: 20%

End of Semester Examination: 70%

k) Tutorials

Tutorial will be offered at the end of each module.

l) Term Paper and Assignments

The term paper and assignments for this course focus on comprehensively understanding of broadcasting systems, including studio design and equipment, broadcasting regulations, frequency spectrum management, and the design and configuration of various broadcasting systems like

CATV, MATV, and MMDS. Additionally, students will explore topics such as multipath problems, transmitter specifications, antenna design, digital and analogue television standards, internet technology, and internet principles, standards, and applications.

m) Contemporary Issues and Industrial Relevance

The course delves into contemporary issues and industrial relevance by exploring broadcasting system elements, regulatory frameworks, spectrum management, antenna design, digital broadcasting standards, and internet broadcasting principles, reflecting the dynamic landscape and technological advancements shaping the broadcasting industry today. Students will gain insights into how these elements intersect with current industry practices, addressing challenges and opportunities in areas such as spectrum allocation, digitalization, and internet-driven content delivery.

BOWEN UNIVERSITY, IWO
Faculty of Engineering
Department of Electrical/Electronic Engineering

Course Code: EEE 507 **Course Title:** Design of Electrical and ICT Services
Semester: First **Credit Hours**: 2 hours
Contact Hours: Lecture - Two hours lectures per Week
Location: New Horizon **Lecturer(s)**: Dr. S. I. Ojo
Textbooks and other Materials:

1. Electrical Installations in the Building – Designing (2023) by Joanna Nazarko, MA
2. Topological Analysis of Networks by Gregory Provan

a) Course Overview and description

This course provides a comprehensive overview of electrical installations, covering topics such as distribution systems, illumination, cable types, and earth protection. Additionally, it includes instruction on auxiliary electrical systems, telecommunication design and installation, computer networking, satellite installation, surge protection, earthing principles, contract proposal preparation, costing, commissioning, and environmental impact assessment, offering students practical skills for designing, installing, and assessing electrical and telecommunication systems.

b) Pre-requisites: Nil

c) Co-requisite(s): Nil

d) Role in Curriculum: Core

e) Course Learning Outcome (CLO) and Programme Outcomes (PO)

Course Learning Outcomes: upon successful completion of the course, students will be able to:	**Suitable Bloom Taxonomy Relevant to the CLOs**	**POs**	**Assessment Tools**
Develop expertise in designing and installing electrical systems for various applications in accordance with safety regulations set by IEE and NSE	5	5, 7, 8	Assignment, quizzes and Exams
Demonstrate knowledge in design and install auxiliary electrical systems like fire alarms, telephone systems, and elevator circuits.	3	2, 6	Assignment, quizzes and Exams
Develop students with the skills to design computer networks, considering factors like topology, cables, cabling methods, and necessary calculations	5	3, 5	Assignment, quizzes and Exams
Develop essential skills for professional practice in electrical engineering. This includes surge and lightning protection concepts, earthing system design based on resistivity measurements, and equipment selection/installation	5	5, 11	Assignment, quizzes and Exams

f) Mapping of CLOs to relevant POs

Course Learning Outcomes	Programme Outcome											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Develop expertise in designing and installing electrical systems for various applications in accordance with safety regulations set by IEE and NSE					**3**		**3**	**3**				
Demonstrate knowledge in design and install auxiliary electrical systems like fire alarms, telephone systems, and elevator circuits.		**2**				**3**						
Develop students with the skills to design computer networks, considering factors like topology, cables, cabling methods, and necessary calculations			**3**		**3**							
Develop essential skills for professional practice in electrical engineering. This includes surge and lightning protection concepts, earthing system design based on resistivity measurements, and equipment selection/installation					**3**						**3**	

Keys: 1 = slightly related, 2 = moderately related, 3 = highly related

g) Expectations of Students

a. Attend 2 hours of lectures per week

b. Turn in assignments considered suitable by the tutors

c. Complete continuous assessment which involves mid-semester test

d. Complete a $2\frac{1}{2}$-hour comprehensive final examination at the end of the semester.

h) Methods of Lecture Delivery/Teaching Aids

Lecture Delivery Methods

Educator-Student Interaction (Discussion method and analogies)

Teaching Aids

Visual Aids (Use of Power Point slides, Lecture templates-handouts)

i) Course Content or Outline

Topics	Weeks
Basic electrical installations: • Conduit wiring system • Surface wiring system • Basic connection of domestic wiring system	1
Regulations: • IEE and NSE Regulations • Cables-types, ratings and wiring systems • Earth protection	2 - 3
Auxiliary electrical system: • Fire alarm circuit. • Telephone circuit, PABX, cables, cablings etc • Elevator circuit,	4 - 6
Computer Networking: • Network topology • Satellite and VSAT installation • Surge and lighting protections.	8 - 9
Contract proposal and document preparation. • Costing and preparation of BEME. • Basic Law of Contract • Contract Commissioning • Contract Environmental Impact Assessment (EIA).	10 -12
Lecture free week	13
Revision & Examination	14 - 15

j) Method of Grading Continuous Assessment

Continuous Assessment (Assignment): 10%

Continuous Assessment Test: 20%

End of Semester Examination: 70%

k) Tutorials

Tutorials will be offered at the end of each module.

l) Term Paper and Assignments

Throughout this comprehensive electrical engineering course, students will reinforce theoretical knowledge through practical application in term papers and assignments. These assignments may involve designing electrical installations for various applications (domestic, industrial, and commercial) following safety regulations and considering factors like illumination, cabling, Earthing, and auxiliary systems. Additionally, students may delve into telecommunication design, computer networks, satellite installations, and environmental impact assessments, solidifying their well-rounded skillset for professional practice.

m) Contemporary Issues and Industrial Relevance

This course equips students with the expertise to design and implement safe and efficient electrical systems for various applications, from domestic buildings to complex industrial facilities. It covers critical aspects like lighting design, cabling, regulations, and environmental considerations, preparing graduates for real-world challenges in the electrical engineering industry.

BOWEN UNIVERSITY, IWO
Faculty of Engineering
Department of Electrical/Electronic Engineering

Course Number: MCT 511
Course Title: Invention and Patients
Semester: First
Credit Hours: 2 hours
Contact Hours: Lecture- Two (one hour) lectures per Week
Location: New Horizon Building
Lecturer(s): Dr. P. Ikubanni & Engr. O.T. Olapade

Textbooks and other Materials:

1. Roger Bridgman (2014), 1,000 Inventions and Discoveries. (3rd Edition), DK Publishing, Inc., 375 Hudson Street New York, NY 10014.
2. Chris Woodford (2023), Technology Timeline. www.explainthatstuff.com. Retrieved October 31, 2023.Copyright Act (2022), Federal Republic of Nigeria Official Gazette. Retrieved December 6, 2023.

a) Course Overview and Description

The course is organized to promote better understanding of the importance of discoveries and innovations engineering as it applies to most engineering professions. It is an interdisciplinary field that applies the concepts of discoveries, inventions, and innovations to various areas of science and engineering. It investigates the relationship between inventions and its role towards economic development of a nation and the world at large. It incorporates various covers to protect intellectual property of the inventor in line with the prescribed law(s).

b) Pre-requisites: MCT 208

c) Co- requisites: Nil

d) Role in Curriculum: Required (Engineering Topics)

e) Course Learning Outcome (CLO) and Programme Outcomes (PO)

Course Learning Outcomes: upon successful completion of the	**Suitable Bloom Taxonomy**	**POs**	**Assessment Tools**

course, students will be able to:	**Relevant to the CLOs**		
Analyze how previous knowledge in Engineer in society relates to the various discoveries and inventions made in science & engineering	**3**	**1, 2**	Homework, quizzes and Exams
Compare the relationship between discoveries, inventions and the impact on technological and economic development of a nation and the world at large.	**4**	**1, 2**	Homework, quizzes and Exams
Assess how to patent their inventions through relevant authorities.	**6**	**1, 2, 5**	Homework, quizzes and Exams

f) Mapping of CLOs to POs

Course Learning Outcomes	**Programme Outcomes**											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Analyze how previous knowledge in Engineer in society relates to the various discoveries and inventions made in science & engineering	3	3										
Compare the relationship between discoveries, inventions and the impact on technological and economic development of a nation and the world at large.	3	3										
Assess how to patent their inventions through relevant authorities.	3	3			3							

Keys: 1 = Slightly related, 2 = Moderately related, 3= Highly related

g) Expectations of Students

a. No late coming to class.

b. A minimum of 75% class attendance is required to take the course examination.

c. A minimum standard of 40% is required to pass the course.

h) Methods of Lecture Delivery/Teaching Aids

Lecture Delivery Methods

Educator-Student Interaction (Discussion method)

Teaching Aids

Visual Aids (Lecture templates-handouts)

i) Course Content or Outline

Topics	Weeks
• Discoveries, Inventions and their contributions to Development • The Background History of Inventions. • Economic Impacts of Inventions on Worldwide development. • Examples of Inventions in various fields of Technology, Management Socio-economic and Political Systems • Examples of Inventions in various fields of Technology, Management Socio-economic and Political Systems (Cont.)	1 – 5
• Patents and Need for Patency • Procedure to Obtain the various types of cover • Breaches of Patent Right – the Legal Angle • Patency in Developing Economics • Copyrights and Trademark	6-10
• Copyright and Trademark interferences • Copyright and Trademark interferences (Cont.)	11 – 13
Lecture free week	13
Revision & Examination	14 -15

j) Method of Grading Continuous Assessment

Continuous Assessment Test 1: **15%**

Continuous Assessment Test 2: **15%**

End of Semester Examination: **70%**

k) Tutorials

Tutorials ae taken at the end of each module.

l) Term Paper and Assignments

Assignments/Students Activities will be 60% dependent on the discovery made, questions arising from class discussion and during lectures.

m) Contemporary Issues and Industrial Relevance

Very relevant especially in the field of Engineering. It specifically addresses the field of Engineering generally concerning understanding and analyzing various scientific discoveries and stages of human technological and economic development.

BOWEN UNIVERSITY, IWO
Faculty of Engineering
Department of Mechatronics Engineering

Number: MCT 504
Course Title: Engineering Economics
Semester: First
Credit: 2 Credits
Contact Hours: 2 hours lectures per Week
Location: New Horizon
Lecturer (s): DR. S.A. Ajayi

Textbooks and other Materials

i. **Engineering Economics: Decision Making for Engineers** by Leland Blank and Anthony Tarquin (Comprehensive overview of economic principles applied to engineering)
ii. **Fundamentals of Engineering Economics** by Chan S. Park (Clear explanations and practical examples)
iii. **Engineering Economy for Project Appraisal** by D.G. Newman (Project management and cost analysis focus)
iv. **Economic Analysis for Engineers** by H.G. Campbell (Emphasizes economic decision-making under uncertainty)

Course Description

This course equips engineers with the essential tools to bridge the gap between technical expertise and sound economic decision-making. Students will delve into the fundamentals of engineering economics, mastering financial analysis techniques to evaluate projects, investments, and resource allocation in the engineering landscape.

Course Learning Outcome (CLO) and Programme Outcomes (PO)

Course Learning Outcomes: upon successful completion of the course, students should be able to:	**Suitable Bloom Taxonomy Relevant to the CLOs**	**POs**	**Assessment Tools**

Apply economic principles to critically analyze the feasibility and profitability of engineering projects.	3,4,5	3,5,7	Assignment, Quizzes & Exam
Utilize financial tools like cash flow analysis, capital budgeting techniques, and life-cycle costing for informed decision-making.	4,5	4,5	Assignment, Quizzes & Exam
Evaluate different project financing options and assess their implications for project success.	3,4	3,4	Assignment, Quizzes & Exam
Integrate social and environmental considerations alongside economic analysis for responsible engineering.	3,5	7	Assignment, Quizzes & Exam
Grasp the economic and societal impacts of engineering projects.	3,4,5	7	Assignment, Quizzes & Exam
Evaluate different project financing options and assess their implications for project success.	3,5	3,4	Assignment, Quizzes & Exam

Mapping of CLOs to POs

Course Learning Outcomes (CLOs)	**Program Outcomes (POs)**											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Apply economic principles to critically analyze the feasibility and profitability of engineering projects.			3		2		2					
Utilize financial tools like cash flow analysis, capital budgeting techniques, and life-cycle costing for informed decision-making.				2	5							
Evaluate different project financing options and assess their implications for project success.			2	3								
Integrate social and environmental considerations alongside economic analysis for responsible engineering.							3					
Grasp the economic and societal impacts of engineering projects.							3					
Evaluate different project financing options and assess their implications for project			2	3								

success.												

Keys: 1 = Slightly related, 2 = Moderately related, 3= Highly related

Coursework and Assessment:

- **Weekly Assignments & Problem Sets:** Solidify your understanding by applying economic principles to solve engineering-related problems.
- **Midterm Exam:** Evaluate your comprehension of core concepts and financial analysis techniques.
- **Final Project (Optional):** Conduct an in-depth economic analysis of a real-world engineering project, showcasing your ability to apply learned concepts to practical scenarios (e.g., evaluating the feasibility of a renewable energy system or infrastructure development project).
- **Class Participation and Presentations:** Actively engage in discussions, debates, and presentations to demonstrate your understanding and critical thinking skills.

Prerequisites

A basic understanding of physics, chemistry, and thermodynamics is highly beneficial. These subjects provide a strong foundation for comprehending the energy conversion principles behind various renewable energy technologies (relevant if the course touches on such topics).

Methods of Lecture Delivery/Teaching Aids

This course aims to engage students in the fascinating world of engineering economics. Here are some methods of lecture delivery and teaching aids that can enhance student learning and create a dynamic learning environment:

Interactive Lectures:

- **Clear Explanations:** Break down complex economic concepts into manageable pieces using clear language with relevant examples.
- **Visual Aids:** Utilize presentations with diagrams, charts, graphs, and real-world photographs to illustrate concepts and enhance understanding.
- **Real-World Applications:** Integrate case studies, news articles, and industry examples throughout lectures to demonstrate the practical applications of engineering economics.
- **Problem-Solving Integration:** Pose short, in-class problems or questions related to the lecture material to encourage active participation and application of learning.

Engaging Activities:

- **Group Discussions and Debates:** Facilitate discussions and debates on economic challenges faced by engineering projects. Divide students into groups to analyze case studies from different perspectives.
- **Interactive Simulations:** Utilize online simulations or software tools (if available) that allow students to experiment with different economic variables and see their impact on project outcomes (e.g., cost estimation tools, life-cycle costing software).
- **Role-Playing Activities:** Simulate real-world scenarios like project financing negotiations or engineering team discussions on budget constraints. This allows students to apply their knowledge and develop communication skills.

Technology-Enhanced Learning:

- **Flipped Classroom Approach (Optional):** Provide pre-recorded lectures or online resources for students to review independently. Class time can be dedicated to interactive activities, problem-solving sessions, and discussions.
- **Online Collaboration Tools:** Utilize online platforms or collaborative documents for group projects, allowing students to work on assignments remotely and share ideas effectively.
- **Guest Lectures (Optional):** Invite industry professionals working in engineering economics to deliver online guest lectures or participate in video conferences. This provides students with valuable insights from practitioners.

Module Structure (13 Weeks):

S/N	ACTIVITIES	WEEKS
1	**Introduction and Fundamentals** • **Economic Fundamentals for Engineers:** Scarcity, opportunity cost, market structures, supply and demand. • **Financial Statements and Analysis:** Understanding income statements, balance sheets, and cash flow statements. • **Time Value of Money:** Present value, future value, internal rate of return (IRR), and net present value (NPV) calculations.	1-2
2	**Cost Estimation and Project Analysis** • **Cost Engineering Principles:** Estimating capital costs, operation and maintenance (O&M) costs, life-cycle costs. • **Cash Flow Analysis for Engineering Projects:** Project cash flow models, sensitivity analysis, break-even analysis. • **Capital Budgeting Techniques:** Internal Rate of Return (IRR), Net Present Value (NPV), Payback Period, and Modified Internal Rate of Return (MIRR). • **Risk and Uncertainty in Engineering Projects:** Probability concepts, Monte Carlo simulations, decision trees.	2-4
3	**Project Financing and Investment Decisions** • **Sources of Project Financing:** Debt financing, equity financing, public-private partnerships (PPPs). • **Financial Ratios and Credit Analysis:** Evaluating the financial health of potential lenders or investors.	5-6

	• **Project Risk Management:** Risk identification, mitigation strategies, sensitivity analysis. • **Investment Decision-Making:** Considering financial return, risk profile, and project alignment with corporate strategy.	
4	**Depreciation and Replacement Analysis** • **Depreciation Methods:** Straight-line depreciation, double-declining balance, and sum-of-the-years-digits (SYD) methods. • **Replacement Analysis:** Evaluation of equipment or technology replacement based on economic considerations. • **Life-Cycle Costing:** Accounting for all costs (acquisition, operation, disposal) over a project's life cycle. • **Case Studies:** Applying economic analysis techniques to real-world engineering projects.	7-8
5	**Economic Evaluation in Engineering Practice** • **Cost-Benefit Analysis (CBA):** Evaluating the economic and social benefits of engineering projects. • **Engineering Ethics and Social Responsibility:** Considering environmental and societal impacts alongside economic profitability. • **Benefit-Cost Ratio (BCR):** Comparing the total benefits of a project to its total costs. • **Cost-Effectiveness Analysis:** Evaluating alternative solutions for achieving the same objective.	9-10
6	**Special Topics (Optional)** • **Real Options Analysis:** Valuing the flexibility to defer, expand, or abandon an investment. • **Game Theory in Engineering Economics:** Analyzing strategic decision-making scenarios in an engineering context. • **Public Policy and Economic Analysis for Engineering Projects:** Understanding the role of government policies and regulations in project economics. • **Guest Speaker:** Invite a professional with experience in engineering economics to share their insights.	11-12
7	**Course Wrap-Up** • **Course Review and Key Takeaways:** Summarize key concepts, tools, and frameworks learned.	13

	• **Student Project Presentations (Optional):** Students present their final project related to economic analysis of an engineering project. • **Final Exam:** Comprehensive assessment of student learning through a combination of questions on fundamental concepts, problem-solving scenarios, and case studies.	

Coursework and Assessment

- **Weekly Assignments:** Apply course concepts to case studies and real-world engineering scenarios through problem sets.
- **Midterm Exam:** Evaluation of understanding of core economic principles and financial analysis techniques.
- **Final Project (Optional):** Students independently analyze the economic feasibility of an engineering project using learned tools (e.g., cost estimation, NPV calculation, cost-benefit analysis).
- **Class Participation:** Active engagement in discussions, case study analysis, and group activities.

Contemporary Issues and Industrial Application

This course expands upon the core principles of engineering economics by exploring contemporary issues and their impact on industrial project decision-making.

Contemporary Issues and Emerging Trends

- **Sustainable Engineering and Life Cycle Assessment (LCA):** Integrating environmental considerations into economic analysis. Costing environmental impacts and their mitigation strategies.
- **The Sharing Economy and Disruptive Technologies:** Evaluating the economic viability of new business models like shared mobility or distributed energy systems.
- **Big Data and Analytics in Engineering Economics:** Leveraging data analytics for project cost estimation, risk assessment, and informed decision-making.
- **Engineering Economics in a Globalized Context:** Considering currency fluctuations, political risk, and global supply chains in project analysis.

Case Studies and Industry Applications (Integrated Throughout)

- Supplement lectures with real-world case studies that showcase the application of engineering economic principles in various industries.
- Examples could include:
  - Economic evaluation of renewable energy projects compared to traditional fossil fuel options.
  - Cost-benefit analysis of implementing energy-efficient technologies in manufacturing plants.
  - Life-cycle costing of electric vehicles versus gasoline-powered vehicles.

- Project financing strategies for large-scale infrastructure projects in developing countries.

BOWEN UNIVERSITY, IWO
Faculty of Engineering
Department of Electrical/Electronic Engineering

Course Number: EEE 531
Course Title: Telecommunication System Engineering I
Semester: First
Credit Hours: 2 hours
Contact Hours: Lecture – Two hours of lectures per Week
Location: New Horizon
Lecturer(s): Engr Ogundoyin, S. O.
Textbooks and other Materials:

1. *Roger, L. Freeman* (2004) Telecommunication System Engineering, Fourth Edition, Wiley & Sons, Inc.

a) Course Overview and description

This course equips you to analyze and design systems that regulate behaviour, from mechanical processes to electrical circuits. You'll learn how to model systems mathematically, analyze stability, and use tools like Bode plots and root locus to predict system response. This knowledge is fundamental for designing control systems in various engineering fields.

b) Pre-requisites: Nil

c) Co-requisite(s): Nil

d) Role in Curriculum: Elective

e) Course Learning Outcome (CLO) and Programme Outcomes (PO)

Course Learning Outcomes: upon successful completion of the course, students will be able to:	**Suitable Bloom Taxonomy Relevant to the CLOs**	**POs**	**Assessment Tools**
Outline the principle of telephony and switching	4	1, 2	Assignments, quizzes and Exams
Develop traffic considerations and the structure of telephone networks, including telegraphy, telex, and facsimile transmission codes.	5	1, 3	Assignments, quizzes and Exams
Compare data transmission, including frequency division multiplexing, time division multiplexing, and various data transmission methods.	4	1, 3, 5, 8, 12	Assignments, quizzes and Exams
Analyze satellite communication systems and multiple access methods, including Earth stations for international telephony and television.	4	1, 3, 8, 12	Assignments, quizzes and Exams

f) Mapping of CLOs to relevant POs

Course Learning Outcomes	**Programme Outcomes**											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Outline the principle of telephony and switching	3	3										
Develop traffic considerations and the structure of telephone networks, including telegraphy, telex, and facsimile transmission codes.	3		3									
Compare data transmission, including frequency division multiplexing, time	3		3		2			3				2

division multiplexing, and various data transmission methods.												
Analyze satellite communication systems and multiple access methods, including Earth stations for international telephony and television.	3		3					2				2

Keys: 1 = Slightly related, 2 = Moderately related, 3= Highly related

g) Expectations of Students

a. Attend 2 hours of lectures per week

b. Turn in assignments and projects as considered suitable by the tutors

c. Complete continuous assessment which involves mid-semester test

d. Complete a 2-hour comprehensive final examination at the end of the semester.

h) Methods of Lecture Delivery/Teaching Aids

Lecture Delivery Methods

Educator-Student Interaction (Discussion method and analogies)

Teaching Aids

Visual Aids (Use of PowerPoint slides, Lecture templates-handouts)

i) Course Content or Outline

Topics	Weeks
Introduction to Telephony Systems • History of Telephony: Evolution of telephone communication from basic analogue systems to digital technology. • Principles of Automatic Telephony and Switching: Functionality of switching systems, call setup and teardown processes.	1 - 2
Switching Systems • Strowger and Crossbar Exchanges: Operation principles, limitations, and historical significance. • Electronic Switching Systems: Advantages over mechanical systems, architecture, and types (space-division, time-division). • Stored Programme Control (SPC) Exchanges: Introduction to software-controlled switching systems, benefits of SPC.	3 - 4
Traffic Engineering in Telecommunication Networks • Traffic Considerations: Measuring call traffic (Erlang B formula), traffic engineering principles for network capacity planning.	5 - 6
Transmission Systems • Transmission Standards: Transmission media (twisted pair, coaxial cable, fibre optic) and their characteristics. • Telephone Network Structure: Hierarchical network architecture, local loop, long-distance transmission.	7 - 8
Data Transmission and Multiplexing • Telegraphy, Telex, and Facsimile: Principles of data transmission over telephony networks, historical data transmission methods. • Frequency Division Multiplex (FDM): Concept of FDM, channel allocation, applications in telephony. • Time Division Multiplex (TDM): Concept of TDM, framing, multiplexing techniques (TDM, Synchronous TDM).	9 - 10
Introduction to Satellite Communication Systems • Advantages and Applications of Satellite Communication Systems: Transmission over long distances, reaching remote areas. • Multiple Access Methods: Techniques for sharing satellite resources among multiple users (FDMA, TDMA, CDMA). • Earth Stations: Design considerations for earth stations used in international telephony and television transmission.	11-12
Course Review and Summary: Recap of key concepts covered in the course.	13
Revision & Examination	14 - 15

j) Method of Grading Continuous Assessment

Continuous Assessment (Assignment): 10%

Continuous Assessment Test: 20%

End of Semester Examination: 70%

k) Tutorials

Tutorial will be offered at the end of each module.

l) Term Paper and Assignments

The term paper challenges you to design a solution for a specific communication need. Utilize your knowledge of switching, multiplexing, and potentially satellite systems. Weekly assignments solidify your understanding through calculations, network diagrams, and exploring real-world communication scenarios.

m) Contemporary Issues and Industrial Relevance

This course keeps you on top of trends in telecommunication, from ever-growing data demands to the rise of satellite internet. Understanding these systems is crucial for industries like mobile communication providers, internet service providers, and space agencies. The knowledge you gain is fundamental for designing and maintaining the communication infrastructure of tomorrow.

BOWEN UNIVERSITY, IWO
Faculty of Engineering
Department of Mechatronics Engineering

Course Number: MCT 509
Course Title: Engineering Law and Management
Semester: First
Credit Hours: 2 hours
Contact Hours: Lecture - Two hours lectures per Week
Location: New Horizon
Lecturer(s): Dr. S.A. Ajayi
Textbooks and other Materials:

- Textbook: "Engineering Law for Professionals" by Donald G. Newman https://www.amazon.com/gp/bestsellers/books/10925/ref=pd_zg_hrsr_b_1_5_last
- Case studies: Relevant court cases related to engineering failures and contractual disputes
- Textbook: "A Guide to the Project Management Body of Knowledge (PMBOK Guide)" by Project Management Institute https://www.pmi.org/pmbok-guide-standards/foundational/pmbok
- Articles on risk management in engineering projects

Learning Objectives:

- Understand fundamental legal principles relevant to engineering practice.
- Analyze contractual agreements and identify potential risks in engineering projects.
- Apply engineering ethics and professional conduct standards.
- Develop project management skills for effective planning, execution, and control.
- Gain insights into leadership principles and effective team management within engineering contexts.
- Explore intellectual property law and its implications for engineering innovation.
- Identify and mitigate potential legal and regulatory risks in engineering projects.

Course overview

This intensive course bridges the gap between technical engineering skills and the legal and managerial realities engineers face. Gain a competitive edge by learning to:

Navigate Contracts and Law: Analyze contracts, identify legal risks, and apply ethical principles in engineering projects.

Master Project Management: Manage projects effectively using scheduling techniques and risk mitigation

strategies.
Understand Intellectual Property: Explore how intellectual property law impacts engineering innovation.
Through case studies, project planning exercises, and research opportunities, you'll graduate with the knowledge and skills to excel in both technical and professional aspects of your engineering career.

Course Description

This course equips graduate engineers with the essential knowledge and skills to navigate the legal and managerial complexities encountered in engineering projects and organizations. It bridges the gap between technical expertise and the broader professional context engineers operate within.

Key Areas of Focus

- **Engineering Law Fundamentals:** Grasp core legal principles like contracts, torts, intellectual property, and their implications for engineering practice.
- **Project Management:** Master project life cycle stages, scheduling techniques, risk management, and effective leadership for successful project execution.
- **Engineering Ethics and Professional Conduct:** Develop strong ethical decision-making skills and understand professional responsibilities in various engineering scenarios.

Pre-requisites: MCT 208
Co- requisites: Nil
Role in Curriculum: Required (Engineering Topics)
Course Learning Outcome (CLO) and Programme Outcomes (PO)

Course Learning Outcomes: upon successful completion of the course, students will be able to:	**Suitable Bloom Taxonomy Relevant to the CLOs**	**POs**	**Assessment Tools**
Analyze contracts, identify legal risks, and apply ethical principles in engineering projects.	**3**	**1, 2, 12**	Homework, quizzes and Exams
Manage projects effectively using scheduling techniques, risk mitigation strategies, and communication skills.	**6**	**1, 2, 12**	Homework, quizzes and Exams
Understand intellectual property law and its impact on engineering innovation.	**2**	**1, 2, 5**	Homework, quizzes and Exams
Navigate legal and regulatory frameworks relevant to specific engineering disciplines.	**6**	**1, 2, 5, 10**	

Mapping of CLOs to POs

Course Learning Outcomes	**Programme Outcomes**											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Analyze contracts, identify legal risks, and apply ethical principles in engineering projects.	3	3										**3**
Manage projects effectively using scheduling techniques, risk mitigation strategies, and communication skills.	3	3										**3**
Understand intellectual property law and its impact on engineering innovation.	3	3			3							
Navigate legal and regulatory frameworks relevant to specific engineering disciplines.	3	3			3					3		

Keys: 1 = Slightly related, 2 = Moderately related, 3= Highly related

Coursework

- Case studies analyzing legal and ethical dilemmas in engineering.
- Project management plan development and risk mitigation strategies for engineering projects.
- Research projects exploring specific legal or regulatory issues within chosen engineering fields.
- Presentations on project management and engineering ethics topics.

Benefits for Engineers

- Gain a competitive edge by understanding legal and business aspects of engineering projects.
- Enhance decision-making skills for ethical and responsible engineering practice.
- Develop leadership proficiency for managing engineering teams and projects effectively.

Pre-requisite

This 500-level course is designed for graduate engineers with a strong foundation in engineering principles. To ensure success in the course, students are expected to have the following prerequisites:

- **Solid Engineering Background:** A bachelor's degree in engineering (or a related technical field) is required.

- **Fundamental Engineering Knowledge:** Familiarity with core engineering concepts like mechanics, mathematics, and engineering design is essential.
- **Understanding of Engineering Ethics:** Prior exposure to engineering ethics principles or professional codes of conduct is beneficial.

Additional Considerations:

- **Calculus and Linear Algebra:** Proficiency in calculus and linear algebra is helpful for understanding some aspects of the course, particularly when analyzing engineering systems and project management techniques.
- **Technical Writing Skills:** The ability to communicate effectively in writing is important for research projects, case study analyses, and project reports.

Waivers and Exceptions:

Students lacking a specific prerequisite but possessing strong engineering experience and relevant skills may petition the instructor for a waiver on a case-by-case basis.

Pre-requisites

O'Level Result, JAMB Subject Combination of Mathematics, Physics, Chemistry, and English Language and must have pass all the courses from year 1-4.

Course Status

Compulsory course

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

Specific objectives

Engineering Law Fundamentals:

- Explain the basic principles of the legal system and its relevance to engineering practice.
- Analyze different types of engineering contracts (e.g., fixed-price, cost-plus) and identify key clauses.
- Apply basic legal principles to common engineering scenarios involving torts (e.g., product liability) and intellectual property (e.g., copyrights).
- Identify potential legal risks associated with engineering projects and propose mitigation strategies.

Project Management for Engineers:

- Describe the project life cycle and its different stages (initiation, planning, execution, monitoring and control, closure).
- Utilize basic project management tools like Gantt charts to schedule engineering projects.
- Identify and assess potential risks associated with engineering projects and develop risk mitigation plans.
- Estimate project costs and develop a basic project budget.

Engineering Ethics and Professional Conduct:

- Articulate the core principles of engineering ethics as outlined in relevant codes of conduct (e.g., NSPE Code of Ethics).

- Analyze ethical dilemmas in engineering practice, considering factors like safety, cost, and environmental impact.
- Understand the concept of whistleblower protection and its role in promoting ethical conduct.

Integration of Law and Management:

- Explain how legal considerations influence project management decisions in engineering projects.
- Analyze the impact of intellectual property law on engineering innovation and technology development.
- Identify and research specific legal and regulatory frameworks relevant to a chosen engineering discipline (e.g., construction law for civil engineers).

Communication and Critical Thinking:

- Effectively communicate legal and technical concepts in writing, both through assignments and class discussions.
- Critically analyze case studies and real-world scenarios involving engineering law and management principles.
- Develop well-reasoned arguments and ethical justifications for engineering decisions.

Methods of Lecture Delivery/Teaching Aids

- Lecture Delivery Methods
  Educator-Student Interaction (Discussion method) Tutorial Method
- Teaching Aids
  Visual Aids (Use of PowerPoint slides)

S/N	ACTIVITIES	WEEKS
1	**Engineering Law Fundamentals** • Introduction to legal systems and the engineering profession • Contract law: formation, types, interpretation, and breach of contracts • Torts and product liability: legal implications of engineering failures • Intellectual property law: patents, copyrights, trademarks, and trade secrets	1-3
2	**Project Management for Engineers** • Project life cycle: initiation, planning, execution, monitoring and control, closure • Project scheduling techniques: Gantt charts, PERT/CPM • Risk management: identification, assessment, mitigation, and contingency planning	4-6

	• Cost estimation and budgeting for engineering projects • Leadership and communication skills in project management	
3	**Engineering Ethics and Professional Conduct** • Codes of ethics for professional engineers (e.g., NSPE Code of Ethics) • Ethical dilemmas in engineering practice (e.g., safety vs. cost considerations) • Whistleblower protection and professional responsibility • Sustainability and environmental considerations in engineering decision-making	7-9
4	**Law and Management in Specific Engineering Fields** • (Select 2-3 topics based on instructor expertise or student interest) • Construction law and contracting for civil engineers • Intellectual property management in technology and software engineering • Environmental regulations and compliance for environmental engineers • Regulatory frameworks and safety standards in specific engineering disciplines (e.g., biomedical engineering)	10-12
5	**Course Review and Presentations** • Review of key concepts from the course • Student presentations on research projects or case studies • Course evaluations	13

Engineering Law and Management: Contemporary Issues and Industrial Relevance

The intersection of engineering law and management is more crucial than ever in today's rapidly evolving technological landscape. This course will not only equip you with foundational knowledge, but also highlight its connection to pressing contemporary issues and its impact on various industries.

Contemporary Issues:

- **Emerging Technologies:** The rise of fields like artificial intelligence, robotics, and autonomous systems creates new legal challenges and ethical considerations. You'll explore legal frameworks and regulations being developed to govern these technologies responsibly.

- **Cybersecurity:** As engineering systems become increasingly interconnected, the risk of cyberattacks rises. The course will address the legal implications of data breaches and strategies for securing critical infrastructure.

- **Sustainability:** Balancing technological advancements with environmental responsibility is a key concern. You'll learn how engineering law and management can be used to promote sustainable practices, manage environmental risks, and comply with environmental regulations.

Industrial Relevance:

- **Globalized Engineering:** Engineering projects often involve collaboration across borders. You'll explore the legal complexities of international contracts, intellectual property protection in different jurisdictions, and navigating diverse regulatory environments.
- **Project Management and Risk Mitigation:** Effective project management minimizes legal and financial risks. The course will demonstrate how legal considerations are integrated into project planning, risk assessments, and contract negotiations within various industries.
- **Leadership and Ethical Decision-Making:** Engineering managers face complex ethical dilemmas. You'll explore how to apply ethical principles and legal frameworks to make responsible decisions regarding safety, innovation, and environmental impact.

BOWEN UNIVERSITY, IWO
Faculty of Engineering
Department of Electrical/Electronic Engineering

Course Number: EEE 532 **Course Title:** Telecommunication System Engineering II
Semester: Second **Credit Hours**: 2 hours
Contact Hours: Lecture – Two hours of lectures per Week
Location: New Horizon **Lecturer(s)**: Engr Ogundoyin, S. O.
Textbooks and other Materials:

1. Roger, L. Freeman (2004) Telecommunication System Engineering, Fourth Edition, Wiley & Sons, Inc.

a) Course Overview and description

This course builds upon your foundation to explore advanced topics. Delve into optical fiber communication systems, including light transmission and reception methods. Analyze radio wave propagation and various radio systems like cellular mobile networks. You will also explore the impact of noise on communication systems, equipping you for robust system design.

b) Pre-requisites: EEE 531

c) Co-requisite(s): Nil

d) Role in Curriculum: Elective

e) Course Learning Outcome (CLO) and Programme Outcomes (PO)

Course Learning Outcomes: upon successful completion of the course, students will be able to:	**Suitable Bloom Taxonomy Relevant to the CLOs**	**POs**	**Assessment Tools**
Differentiate the types of telecommunications systems and their basic engineering features	4	1	Assignments, quizzes and Exams
Assess the principles of submarine systems and transmission hierarchies	6	1, 3	Assignments, quizzes and Exams
Outline the fundamental principles of optical fibre communication systems	4	1, 3	Assignments, quizzes and Exams
Compare the characteristics of radio transmitter and receiver systems	4	1, 5	Assignments, quizzes and Exams
Evaluate the principles of cellular mobile radio and the effect of noise on their performance.	6	1, 3	Assignments, quizzes and Exams

f) Mapping of CLOs to relevant POs

Course Learning Outcomes	**Programme Outcomes**											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Differentiate the types of telecommunications systems and their basic engineering features	3											
Assess the principles of submarine systems and transmission hierarchies	3		3									
Outline the fundamental principles of optical fibre communication systems	3		3									
Compare the characteristics of radio transmitter and receiver systems	3				2							

Evaluate the principles of cellular mobile radio and the effect of noise on their performance.	3		3								

Keys: 1 = Slightly related, 2 = Moderately related, 3= Highly related

g) Expectations of Students

a. Attend 2 hours of lectures per week

b. Turn in assignments and projects as considered suitable by the tutors

c. Complete continuous assessment which involves mid-semester test

d. Complete a 2-hour comprehensive final examination at the end of the semester.

h) Methods of Lecture Delivery/Teaching Aids

Lecture Delivery Methods

Educator-Student Interaction (Discussion method and analogies)

Teaching Aids

Visual Aids (Use of PowerPoint slides, Lecture templates-handouts)

i) Course Content or Outline

Topics	Weeks
Introduction to Telecommunications Systems • Types of Telecommunication Systems: Overview of wired (e.g., copper cable, fiber optic) and wireless (e.g., radio, satellite) communication systems. • Basic Engineering Features: Signal representation (analog, digital), transmission media characteristics (bandwidth, attenuation), modulation techniques (AM, FM).	1
Wired Telecommunication Systems • Voice Frequency (VF) and Coaxial Cable Systems: Mathematical analysis of signal transmission on VF and coaxial cables, bandwidth limitations. • Submarine Cable Systems: Impact of cable length on signal transmission, mathematical modeling of attenuation and distortion. • Transmission Hierarchies: Multiplexing techniques (TDM, FDM), mathematical analysis of bandwidth allocation and channel capacity.	2 - 3
Optical Fiber Communication Systems • Fundamentals of Optical Fiber Communication: Light propagation in fibers, mathematical modeling of attenuation and dispersion. • Electro-Optical and Acousto-Optical Devices: Mathematical analysis of principles behind light sources (LED, laser), detectors (photodiode), and modulators used in fiber optic communication. • Splices and Connectors: Impact of splices and connectors on signal transmission, mathematical analysis of insertion loss and return loss.	4 - 5
Radio Communication Systems • Characteristics of Radio Transmitters and Receivers: Mathematical analysis of power amplifiers, mixers, filters used in radio transmission and reception. • Radio Frequency Bands and Systems: Properties of Medium Wave (MW), High Frequency (HF), Very High Frequency (VHF), and Ultra High Frequency (UHF) bands, mathematical analysis of propagation characteristics. • Point-to-Point Radio Systems: Mathematical modelling of signal propagation in point-to-point radio links, free space path loss calculations.	6 - 8
Cellular Mobile Radio Systems • Principles of Cellular Mobile Radio: Cellular architecture, frequency reuse concept, mathematical analysis of handover process. • Capacity Analysis in Cellular Systems: Mathematical modelling of cell capacity, Erlang B formula for traffic analysis.	9 -10

Noise in Telecommunication Systems • Types of Noise: Thermal noise, shot noise, intermodulation noise, their impact on signal fidelity. • Mathematical Analysis of Noise: Modeling noise power spectral density, signal-to-noise ratio (SNR) calculations. • Techniques for Noise Reduction: Mathematical analysis of error correction coding, modulation techniques for noise mitigation.	11-12
Lecture free week	13
Revision & Examination	14 - 15

j) Method of Grading Continuous Assessment

Continuous Assessment (Assignment): 10%

Continuous Assessment Test: 20%

End of Semester Examination: 70%

k) Tutorials

Tutorial will be offered at the end of each module.

l) Term Paper and Assignments

This term paper challenges you to design a communication system for a specific need, utilizing concepts like fiber optics or cellular mobile radio. Consider noise mitigation strategies. Weekly assignments solidify your understanding through calculations, exploring different system types, and potential simulations.

m) Contemporary Issues and Industrial Relevance

This course keeps you on top of advancements in telecommunications. Mastering fibre optics and cellular technologies are crucial for high-speed data transmission and mobile connectivity. Understanding noise is essential for designing robust systems. The knowledge you gain is vital for industries like internet service providers, mobile network operators, and communication equipment manufacturers. These skills position you to contribute to the ever-evolving world of telecommunication.

BOWEN UNIVERSITY, IWO
Faculty of Engineering
Department of Electrical/Electronic Engineering

Course Code: EEE 534
Course Title: Satellite Communications
Semester: Second
Credit Hours: 2 hours
Contact Hours: Lecture – Tw o hours lectures per Week
Location: New Horizon
Lecturer(s): Dr. S. I. Ojo

Textbooks and other Materials:

1. Dennis Roddy (2006). Satellite Communications, 4th Edition
2. Gérard Maral, Michel Bousquet, Zhili Sun 2020 Satellite Communications Systems: Systems, Techniques and Technology

a) Course Overview and description

The course covers the fundamentals of satellite communication systems, including different satellite types, orbits, and applications. It also dives into the technical aspects like antennas, amplifiers, signal conversion, and link analysis. Furthermore, the course explores mobile communication technologies, from cellular radio systems to standards like GSM and GPS, providing an overview of how mobile communication has evolved.

b) Pre-requisites: Nil

c) Co-requisite(s): Nil

d) Role in Curriculum: Elective

e) Course Learning Outcome (CLO) and Programme Outcomes (PO)

Course Learning Outcomes: upon successful completion of the course, students will be able to:	**Suitable Bloom Taxonomy Relevant to the CLOs**	**POs**	**Assessment Tools**
Differentiate the location of satellites in space	4	1, 2, 4, 12	Assignment, quizzes and Exams
Apply Kepler's laws vis-à-vis their application to the location of satellite in orbit	3	1, 2	Assignment, quizzes and Exams
Compare the difference between Earth segment and Space segment of a satellite communication system	4	1	Assignment, quizzes and Exams
Design a satellite uplink and downlink	5	1, 2	Assignment, quizzes and Exams
Differentiate techniques and trade-offs employed in communicating signals through a satellite.	4	1, 8, 11, 12	Assignment, quizzes and Exams

f) Mapping of CLOs to relevant POs

Course Learning Outcomes	**Programme Outcomes**											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Differentiate the location of satellites in space	**2**	**2**		**3**								**3**
Apply Kepler's laws vis-à-vis their application to the location of satellite in orbit	**3**	**3**										
Compare the difference between Earth segment and Space segment of a satellite communication system	**3**											
Design a satellite uplink and downlink	**2**	**3**										
Differentiate techniques and trade-offs employed in communicating signals through a satellite.	**3**							**2**			**3**	**3**

Keys: 1 = slightly related, 2 = moderately related, 3 = highly related

g) Expectations of Students

a. Attend 2 hours of lectures per week

b. Turn in assignments considered suitable by the tutors

c. Complete continuous assessment which involves mid-semester test

d. Complete a $2^{1}/_{2}$-hour comprehensive final examination at the end of the semester.

h) Methods of Lecture Delivery/Teaching Aids

Lecture Delivery Methods

Educator-Student Interaction (Discussion method and analogies)

Teaching Aids

Visual Aids (Use of Power Point slides, Lecture templates-handouts)

i) Course Content or Outline

Topics	Weeks
Satellite Communication • Types (LEO, GEO, etc.), • orbits, • frequency bands, • applications, and services	1-2
Antennas: • types, gain, pointing loss, G/T, • EIRP; high power amplifiers; l • Low noise amplifiers	3 - 4
BUC/LNB: • Conversion process, polarization hopping, 596 redundancy configurations. • Earth station monitoring and control. • Basic link analysis, attenuation, sources of interference, carrier to noise and interference ratio, system availability • frequency reuse, link budget, • Link design.	5 - 6
Mobile Communication: • Introduction to mobile radio systems • Radio paging, cordless telephones, cellular radio. • Trends in cellular radio and personal communications	7-8
Standards and overview of analogue and digital cellular systems: • AMPS, TACS, GSM, CT2, PCN, DECT, PHS. • Frequency management and channel assignment	9 -11
GSM: • Architecture, elements, and standard interfaces • FDMA/ TDMA structure. • Third Generation Wireless Standard. • Global Positioning System: principles, and applications	12-13
Lecture free week	13
Revision & Examination	14 - 15

j) Method of Grading Continuous Assessment

Continuous Assessment (Assignments) 20%
Continuous Assessment (Test):10%
End of Semester Examination: 70%

k) Tutorials

Tutorials are taken at the end of each module.

l) Term Paper and Assignments

The term paper for this course focus on designing a satellite communication system for a specific application, considering factors like satellite type, link analysis, and network configuration. An assignment involves analyzing a real-world scenario, such as mobile communication network coverage in a remote area and proposing solutions that leverage satellite communication technologies.

m) Contemporary Issues and Industrial Relevance

This course offers valuable insight into critical issues faced by modern communication systems, like congestion and increasing demand. By exploring satellite communication alongside mobile technologies, it equips students to understand the evolving landscape of industrial communication solutions.

BOWEN UNIVERSITY, IWO
Faculty of Engineering
Department of Electrical/Electronic Engineering

Course Code: EEE 535 **Course Title:** Mobile and Personal Communication Systems
Semester: Second **Credit Hours**: 2
Contact Hours: Lecture - Two hours lectures per Week
Location: Alma Rohr **Lecturer(s)**: Dr. S. I. Ojo
Textbooks and other Materials:

1. Raj Pandya, Mobile and Personal Communication Services and Systems (IEEE Series on Mobile & Digital Communications) 1st Edition
2. Raj Pandya (1999). Mobile and Personal Communication Systems and Services

a) Course Overview and description

This course explores the history and technical aspects of mobile communication systems, from early cellular concepts to modern digital standards like GSM. It delves into challenges like signal interference and fading, while also covering network capacity, traffic management, and call processing protocols.

b) Pre-requisites: Nil

c) Co-requisite(s): Nil

d) Role in Curriculum: Elective

e) Course Learning Outcome (CLO) and Programme Outcomes (PO)

Course Learning Outcomes: upon successful completion of the course, students will be able to:	**Suitable Bloom Taxonomy Relevant to the CLOs**	**POs**	**Assessment Tools**
Outline the evolution of mobile radio communication systems	5	1, 2	Assignment, quizzes and Exams
Assess the basic techniques used in improving the communication system capacity	6	1, 2, 8, 12	Assignment, quizzes and Exams
Compare the effects of propagation impairments and their associated problems	4	1	Assignment, quizzes and Exams
Compare the characteristics of different fading channel distributions	4	1, 4	Assignment, quizzes and Exams
Differentiate the standards and overview of analogue and digital cellular systems	4	1, 8, 12	Assignment, quizzes and Exams
Compare the capability and standard of 3G wireless technology	4	1, 5, 8, 12	Assignment, quizzes and Exams

f) Mapping of CLOs to relevant POs

Course Learning Outcomes	**Programme Outcomes**											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Outline the evolution of mobile radio communication systems	**3**	**2**										
Assess the basic techniques used in improving the communication system capacity	**2**	**3**						**2**				**3**
Compare the effects of propagation impairments and their associated problems	**3**											
Compare the characteristics of different fading channel distributions	**3**			**2**								
Differentiate the standards and overview of analogue and digital cellular systems	**3**							**2**				**3**
Compare the capability and standard of 3G wireless technology	**2**				**3**			**3**				**2**

Keys: 1 = slightly related, 2 = moderately related, 3 = highly related

g) Expectations of Students

a. Attend 2 hours of lectures per week

b. Turn in assignments considered suitable by the tutors

c. Complete continuous assessment which involves mid-semester test

d. Complete a $2^1/_2$-hour comprehensive final examination at the end of the semester.

h) Methods of Lecture Delivery/Teaching Aids

Lecture Delivery Methods

Educator-Student Interaction (Discussion method and analogies)

Teaching Aids

Visual Aids (Use of Power Point slides, Lecture templates-handouts)

i) Course Content or Outline

Topics	Weeks
• Evolution and examples of mobile radio communications	1-2
Basic cellular system: • Frequency re-use, • Roaming, • Hand-off strategies, • Co-channel interference, • Traffic and Grade of service	3 - 5
• System capacity and improvement	6 - 7
Propagation path loss: • Multipath propagation problem, • Raleigh fading, Rician distribution	8 - 9
Standards and overview of analogue and digital cellular systems: • AMPS, TACS, GSM, CT2, PCN, DECT, PHS. • Frequency management and channel assignment	10
GSM: • Architecture, elements, and standard interfaces. • Third Generation Wireless Standards. • Paging & SMS services and technologies. • Call Processing. • Signalling, Roaming and mobility management; Route optimization.	11-12
Lecture free week	13
Revision & Examination	14 - 15

j) Method of Grading Continuous Assessment

Continuous Assessment (Assignments): 20%

Continuous Assessment (Test):10%

End of Semester Examination: 70%

k) Tutorials

Tutorials are taken at the end of each module.

l) Term Paper and Assignments

A term paper focus on optimizing a specific aspect of a mobile communication system, such as analyzing call handoff strategies to improve network performance or designing a method to mitigate signal fading in a particular environment. The assignment involves comparing different cellular network standards (e.g., GSM vs. LTE) based on factors like capacity, signal quality, and handover efficiency, considering a specific use case scenario.

m) Contemporary Issues and Industrial Relevance

The course equips students with the knowledge to address critical challenges in mobile communication networks, such as increasing user demand, limited spectrum resources, and signal interference. By understanding cellular network design, propagation effects, and call processing protocols, students can contribute to the development and optimization of next-generation mobile communication technologies used by various industries.

BOWEN UNIVERSITY, IWO
Faculty of Engineering
Department of Electrical/Electronic Engineering

Course Number: EEE 536 **Course Title:** Microwave Engineering
Semester: Second **Credit Hours**: 2 hours
Contact Hours: Lecture - Two hours of lectures per Week
Location: New Horizon Studio 4 **Lecturer(s)**: Dr. J. O. Abolade
Textbooks and other Materials:

1. Engineering Electromagnetics (6th Ed.) by *Hayt, W. H. and Buck, J. A.*
2. *Microwave Engineering (4th Ed.) by D.M. Pozar*
3. *Microwave Engineering: Concepts and Fundamentals by A. S. Khan*

a) Course Overview and description
his microwave engineering course explores how high-frequency electromagnetic waves behave and travel. You'll learn about the components used in microwave systems, including transmission lines, waveguides, and various passive and active devices. The course also covers solid-state microwave devices and measurements at these high frequencies, providing a foundation for understanding modern communication and radar technologies.

b) Pre-requisites: Nil
c) Co-requisite(s): Nil
d) Role in Curriculum: Core
e) Course Learning Outcome (CLO) and Programme Outcomes (PO)

Course Learning Outcomes: upon successful completion of the course, students will be able to:	**Suitable Bloom Taxonomy Relevant to the CLOs**	**POs**	**Assessment Tools**
Analyze plane wave propagation in free space, lossy media and metallic films	4	1, 2	Homework, quizzes and Exams
Differentiate various types of transmission medium	4	1, 12	Homework, quizzes and Exams
Compare between passive and active microwave components	4	1	Homework, quizzes and Exams
Evaluate the characteristics of solid-state microwave devices	6	1, 12	Homework, quizzes and Exams
Analyze the various measurement of microwave frequencies.	4	1, 5	Homework, quizzes and Exams

f) Mapping of CLOs to relevant POs

Course Learning Outcomes	**Programme Outcomes**											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Analyze plane wave propagation in free space, lossy media and metallic films	**3**	**3**										
Differentiate various types of transmission medium	**3**											**1**
Compare between passive and active microwave components	**3**											
Evaluate the characteristics of solid-state microwave devices	**3**											**2**
Analyze the various measurement of microwave frequencies.	**3**				**2**							

Keys: 1 = Slightly related, 2 = Moderately related, 3= Highly related

g) Expectations of Students

a. Attend 2 hours of lectures per week
b. Turn in assignments and projects as considered suitable by the tutors
c. Complete continuous assessment which involves mid-semester test
d. Complete a 2-hour comprehensive final examination at the end of the semester.

h) Methods of Lecture Delivery/Teaching Aids

Lecture Delivery Methods

Educator-Student Interaction (Discussion method) Video Tutorials Electrical systems

Teaching Aids

Visual Aids (Use of PowerPoint slides)

i) Course Content or Outline

Review of plane wave propagation in free space, lossy media and metallic films. Transmission lines and waveguides, passive microwave components – cavity resonators, waveguide Tees, directional couplers, ferrite isolators and circulators. Active microwave components – klystrons, magnetrons, traveling wave tubes, parametric amplifiers. Introduction to solid state microwave devices including varactor, PIN, and gun-effect diodes, photodiodes, phototransistor, and microwave integrated circuits (IC's). Measurements at microwave frequencies.

<table>
<tr><th>Topics</th><th>Weeks</th></tr>
<tr><td>Wave Propagation
Electromagnetic waves travel in free space, including concepts like wave impedance and Poynting vector.
Lossy Media: wave propagation in materials that attenuate the signal (conductors, dielectrics with losses).
Metallic Films: wave behavior at the interface of metallic films, considering phenomena like reflection and skin depth.</td><td>1 - 2</td></tr>
<tr><td>Transmission Lines and Waveguides
Transmission Lines: transmission line theory, covering characteristic impedance, reflection coefficient, and matching techniques.
Waveguides: types of waveguides (rectangular, circular) and how electromagnetic waves propagate within them, including mode analysis.</td><td>3 - 5</td></tr>
<tr><td>Passive Microwave Components
Cavity Resonators
Waveguide Tees and Directional Couplers
Ferrite Isolators and Circulators</td><td>6 - 7</td></tr>
<tr><td>Active Microwave Components
Klystrons and Magnetrons
Traveling Wave Tubes (TWTs)
Parametric Amplifiers</td><td>8 - 9</td></tr>
<tr><td>Introduction to Solid-State Microwave Devices
Varactor Diodes
PIN Diodes
Gun-Effect Diodes
Photodiodes and Phototransistors
Microwave Integrated Circuits (MMICs)
Measurements at Microwave Frequencies
measurement techniques and instrumentation used for characterizing microwave components and systems (network analyzers, vector voltmeters)</td><td>10 -12</td></tr>
<tr><td>Lecture free week</td><td>13</td></tr>
<tr><td>Revision & Examination</td><td>14 - 15</td></tr>
</table>

j) Method of Grading Continuous Assessment

Continuous Assessment (Assignment): 10%
Continuous Assessment Test: 20%
End of Semester Examination: 70%

k) Tutorials

Tutorial will be offered at the end of each module.

l) Term Paper and Assignments

Assignment would be given bi-weekly.

m) Contemporary Issues and Industrial Relevance

This course provides the fundamental knowledge of microwave components and devices essential for designing and analyzing modern communication and radar systems. Understanding these principles is crucial for developing miniaturized microwave circuits and components for various applications, including wireless communication, autonomous vehicles, and the internet of things.

BOWEN UNIVERSITY, IWO
Faculty of Engineering
Department of Electrical/Electronic Engineering

Course Code: EEE 537

Course Title: Digital Communication Principles and Systems

Semester: First

Credit Hours: 30 hours

Contact Hours: Lecture - Two hours lectures per Week

Location: New Horizon Studio 4

Lecturer(s): Dr. D. O. Akande

Textbooks and other Materials:

1. Digital Communication Systems by Simon Haykin, (2014), John Wiley & Sons, Inc.

a) Course Overview and description

This course explores the conversion of analog signals into digital form and their transmission. The course delves into sampling, coding, and modulation techniques (ASK, FSK, etc.) to efficiently transmit information, while also covering essential signal processing tools like the Z-transform and Discrete Fourier Transform for analyzing and manipulating digital signals.

b) Pre-requisites: Nil

c) Co-requisite(s): Nil

d) Role in Curriculum: Elective

e) Course Learning Outcome (CLO) and Programme Outcomes (PO)

Course Learning Outcomes: upon successful completion of the course, students will be able to:	**Suitable Bloom Taxonomy Relevant to the CLOs**	**POs**	**Assessment Tools**
Demonstrate broad knowledge of fundamental principles and technical standards underlying digital communication.	3	1, 9	Assignment, quizzes and Exams
Analyze the performance of digital communication systems in both time and frequency domains, and design systems to meet specific performance requirements.	4	4, 5, 6	Assignment, quizzes and Exams
Evaluate the performance of modulation and demodulation techniques in various transmission environments.	6	4, 6	Assignment, quizzes and Exams
Assess the challenges and techniques involved in transmitting digital signals over analog channels,	6	1, 9	Assignment, quizzes and Exams
Analyze the various techniques in evaluating the performance of digital communication systems.	4	4	Assignment, quizzes and Exams
Design digital communication systems for image processing applications.	5	5, 6	Assignment, quizzes and Exams

f) Mapping of CLOs to relevant POs

Course Learning Outcomes	Programme Outcomes											
	1	2	3	4	5	6	7	8	9	10	11	12
Demonstrate broad knowledge of fundamental principles and technical standards underlying digital communication.	**3**								**3**			
Analyze the performance of digital communication systems in both time and frequency domains, and design systems to meet specific performance requirements.				**3**	**3**	**3**						
Evaluate the performance of modulation and demodulation techniques in various transmission environments.				**3**		**3**						
Assess the challenges and techniques involved in transmitting digital signals over analog channels,	**2**								**2**			
Analyze the various techniques in evaluating the performance of digital communication systems.				**3**								
Design digital communication systems for image processing applications.					**3**	**3**						

Keys: 1 = Slightly related, 2 = Moderately related, 3 = Highly related

g) Expectations of Students

a. Attend 2 hours of lectures per week

b. Turn in assignments and projects as considered suitable by the tutors

c. Complete continuous assessment which involves mid-semester test

d. Complete a 2-hour comprehensive final examination at the end of the semester.

h) Methods of Lecture Delivery/Teaching Aids

Lecture Delivery Methods

Educator-Student Interaction (Discussion, presentation, simulation method)

Teaching Aids

Visual Aids (Use of PowerPoint slides, Lecture templates-handouts)

i) Course Content or Outline

Topics	Weeks
Digital Signal Representation • Introduction to Digital Communication Systems - Advantages, applications. • Analog vs. Digital Signals - Sampling theory (Nyquist-Shannon theorem), aliasing. • Quantization and Coding - Impact on signal fidelity, quantization noise, coding techniques. • Line Coding - Manchester, Differential Manchester, NRZ, Bipolar, etc., for efficient data transmission. • Digital-to-Analog Converters (DACs) - Operation, types (voltage mode, current mode)	1 - 3
Pulse and Data Communication Systems • Analysis of Linear Networks in Communication Systems - Filters, frequency response. • Analysis of Non-linear Networks in Communication Systems - Comparators, Schmitt Triggers. • Switching Theory - Boolean algebra, logic gates, combinational circuits in communication systems. • Noise Immunity and Regenerative Circuits - Noise sources, error detection and correction, repeaters.	4 - 6
Digital Modulation Techniques • Introduction to Digital Modulation - ASK, FSK, PSK - modulation and demodulation techniques. • Advanced Digital Modulation - QPSK, QAM - modulation and demodulation techniques. • Analysis of Modulation Techniques - Signal constellation diagrams, bandwidth requirements. • Digital Transmission on Analog Networks - Channel impairments, modulation techniques for different channels.	7 - 10
Fundamentals of Digital Signal Processing • Time and Frequency Domain Analysis - Discrete-time signals, Fourier Series, Discrete Fourier Transform (DFT). • The Z-Transform - Properties, applications in analyzing discrete systems, poles, and zeros. • Elements of digital filter design, introduction to image processing.	11 - 12
Lecture free week	13
Revision & Examination	14 - 15

j) Method of Grading Continuous Assessment

Continuous Assessment (Assignment): 10%

Continuous Assessment Test: 20%
End of Semester Examination: 70%

k) Tutorials

Tutorials will be offered at the end of each module.

l) Term Paper and Assignments

The core concepts of digital communication systems and their practical implementation deeper into sampling, coding, and modulation techniques through problem-solving and potentially design a basic communication system, Z-transform and FFT are explored as assignments.

m) Contemporary Issues and Industrial Relevance

This course equips the students with the skills to bridge the gap between analog and digital worlds. It assists them to learn how to convert analog signals into a format suitable for transmission using techniques like sampling and coding, while also exploring digital modulation for efficient information transfer. Additionally, the course delves into essential digital signal processing tools like the Z-transform and FFT, preparing you for various applications in communication and data processing.

BOWEN UNIVERSITY, IWO
Faculty of Engineering
Department of Electrical/Electronic Engineering

Course Code: EEE 538 **Course Title:** Information Theory and Coding
Semester: Second **Credit Hours**: 2 hours
Contact Hours: Lecture - Two hours lectures per Week
Location: New Horizon **Lecturer(s)**: Dr. S. I. Ojo
Textbooks and other Materials:

1. J. S. Chitode (2021). Information Theory and Coding
2. Gareth A. Jones and J. Mary Jones (200). Information and Coding Theory

a) Course Overview and description

This course builds a foundation in probability and statistics for analyzing communication systems. It explores how random noise affects different modulation techniques (AM, FM, digital) and introduces key concepts like information entropy and capacity. Students will learn about error control coding and the trade-offs between bandwidth and signal quality in communication channels.

b) Pre-requisites: Nil

c) Co-requisite(s): Nil

d) Role in Curriculum: Elective

e) Course Learning Outcome (CLO) and Programme Outcomes (PO)

Course Learning Outcomes: upon successful completion of the course, students will be able to:	**Suitable Bloom Taxonomy Relevant to the CLOs**	**POs**	**Assessment Tools**
Analyze the Statistical characterization of noise and communication channels	4	1, 2	Assignment, quizzes and Exams
Evaluate the Shannon theorem and Performance of communication systems	6	1, 2	Assignment, quizzes and Exams
Differentiate between entropy, information rate and channel capacity	4	1	Assignment, quizzes and Exams
Outline the importance of security and different type of security technique in wireless communication	4	1, 8	Assignment, quizzes and Exams
Demonstrate the basic features of Trading of bandwidth and S/N ratio	3	1, 11	Assignment, quizzes and Exams
Apply Correlation and power spectral density in modelling of communication system	3	1, 2, 5	Assignment, quizzes and Exams

f) Mapping of CLOs to relevant POs

Course Learning Outcomes	Programme Outcomes											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Analyze the Statistical characterization of noise and communication channels	**2**	**3**										
Evaluate the Shannon theorem and Performance of communication systems	**3**	**2**										
Differentiate between entropy, information rate and channel capacity	**3**											
Outline the importance of security and different type of security technique in wireless communication	**2**							**3**				
Demonstrate the basic features of Trading of bandwidth and S/N ratio	**2**										**3**	
Apply Correlation and power spectral density in modelling of communication system	**3**	**2**			**3**							

Keys: 1 = slightly related, 2 = moderately related, 3 = highly related

g) Expectations of Students

a. Attend 2 hours of lectures per week

b. Turn in assignments considered suitable by the tutors

c. Complete continuous assessment which involves mid-semester test

d. Complete a $2\frac{1}{2}$-hour comprehensive final examination at the end of the semester.

h) Methods of Lecture Delivery/Teaching Aids

Lecture Delivery Methods

Educator-Student Interaction (Discussion method and analogies)

Teaching Aids

Visual Aids (Use of Power Point slides, Lecture templates-handouts)

i) Course Content or Outline

Topics	Weeks
• Review of probability theory and statistics	1
• Introduction to stochastic processes; • Correlation and power spectral density	2 - 3
Statistical characterization • Noise and communication channels. • Performance of communication systems (AM, FM, digital modulations) in the presence of noise	4 - 6
Measure of information • Entropy • information rate • Capacity	8 - 9
Shannon theorem: • Source and channel coding. • Error control coding. • Trading of bandwidth • Signal-to-Noise Ratio (SNR).	10 -12
Lecture free week	13
Revision & Examination	14 - 15

j) Method of Grading Continuous Assessment

Continuous Assessment (Assignments): 20%
Continuous Assessment (Test):10%
End of Semester Examination: 70%

k) Tutorials

Tutorials are taken at the end of each module.

l) Term Paper and Assignments

A term paper for this course focus on applying information theory and error control coding techniques to optimize the communication of a specific data type (text, image, video) through a noisy channel. An assignment involves analyzing and comparing the performance of different modulation techniques (AM, FM, digital) in the presence of noise and channel limitations, considering factors like bandwidth and signal-to-noise ratio.

m) Contemporary Issues and Industrial Relevance

This course addresses real-world challenges in communication systems, such as efficiently transmitting data through increasingly congested channels with limited bandwidth and ever-present noise. By exploring the interplay of information theory, coding techniques, and noise analysis, students gain skills crucial for designing robust communication systems used in various industries.

BOWEN UNIVERSITY, IWO
Faculty of Engineering
Department of Electrical/Electronic Engineering

Course Number: EEE 551
Course Title: Power Systems Engineering I
Semester: First
Credit Hours: 2 hours
Contact Hours: Lecture - Two hours of lectures per Week
Location:
Lecturer(s): Prof. O. A. Komolafe & Mr. J. O. Babalola

Textbooks and other Materials:

- "Power System Analysis and Design" by *J. Duncan Glover, Mulukutla S. Sarma, and Thomas J. Overbye*
- Power System Analysis" by *Hafi Sadat*
- "Power System Analysis" by *John J. Grainger and William D. Stevenson, Jr.*

a) Course Overview and description

The course is structured in such a way to foster in-depth understanding of Electrical Power System components and operations and their relation to power industries. Issues of Safety and Regulations of Electrical installation and operation were given in-depth consideration.

b) Pre-requisites: Nil

c) Co-requisite(s): Nil

d) Role in Curriculum: Elective

e) Course Learning Outcome (CLO) and Programme Outcomes (PO)

Course Learning Outcomes: upon successful completion of the course, students will be able to:	**Suitable Bloom Taxonomy Relevant to the CLOs**	**POs**	**Assessment Tools**
Evaluate the behavior and characteristics of three-phase systems using advanced mathematical models and analytical techniques.	6	1, 2	Homework, quizzes and Exams
Analyze transmission lines representation, including short, medium, and long lines. Apply the equivalent circuit models to calculate power flow and implement reactive compensation strategies.	4	1, 2, 3	Homework, quizzes and Exams
Compare transient phenomena in power transmission systems, including travelling waves and reflections, utilizing advanced analytical methods to assess and mitigate transient disturbances.	4	1, 4	Homework, quizzes and Exams
Assess the advantages and disadvantages of high voltage direct current (HVDC) transmission systems, review current technologies, and propose innovative solutions for enhancing system efficiency and reliability.	6	2, 5	Homework, quizzes and Exams
Design network calculation models to use in Power flow studies using iterative methods such as Gauss-Seidel and Newton-Raphson algorithms.	5	1, 2, 6	Homework, quizzes and Exams
Develop strategies for the control operation of power systems, including voltage and frequency control, real and reactive power flow management, and economic dispatch techniques, integrating engineering principles with financial and management considerations.	5	3, 6, 11	Homework, quizzes and Exams

f) Mapping of CLOs to relevant POs

Course Learning Outcomes	**Programme Outcomes**											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Evaluate the behavior and characteristics of three-phase systems using advanced mathematical models and analytical techniques.	**3**	**3**										
Analyze transmission lines representation, including short, medium, and long lines. Apply the equivalent circuit models to calculate power flow and implement reactive compensation strategies.	**3**	**3**	**3**									
Compare transient phenomena in power transmission systems, including travelling waves and reflections, utilizing advanced analytical methods to assess and mitigate transient disturbances.	**3**			**3**								
Assess the advantages and disadvantages of high voltage direct current (HVDC) transmission systems, review current technologies, and propose innovative solutions for enhancing system efficiency and reliability.		**3**			**3**							
Design network calculation models to use in Power flow studies using iterative methods such as Gauss-Seidel and Newton-Raphson algorithms.	**3**	**3**				**3**						
Develop strategies for the control operation of power systems, including voltage and frequency control, real and reactive power flow management, and economic dispatch techniques, integrating engineering principles with financial and management considerations.			**3**			**3**					**3**	

Keys: 1 = Slightly related, 2 = Moderately related, 3= Highly related

g) Expectations of Students

a. Attend 2 hours of lectures per week

b. Turn in assignments and projects as considered suitable by the tutors

c. Complete continuous assessment which involves mid-semester test

d. Complete a 2-hour comprehensive final examination at the end of the semester.

h) Methods of Lecture Delivery/Teaching Aids

Lecture Delivery Methods

Educator-Student Interaction (Discussion method) Video Tutorials Electrical systems

Teaching Aids

Visual Aids (Use of PowerPoint slides, Lecture templates-handouts)

i) Course Content or Outline

Topics	Weeks
• Overview of three-phase systems • Introduction to power elements • Mathematical modeling of power elements • Representation of transmission lines	1 - 2
• Short, medium, and long transmission lines • Equivalent circuit modeling • Reactive compensation techniques • Transmission line transients	3 - 4
• Travelling waves and reflections • Justification and disadvantages of HVDC transmission • Review of current DC transmission technologies • Lightning arresters: principles and applications	5 - 6
• Network calculation methods • Develop power flow equations • Power flow solution by Gauss-Seidel and Newton-Raphson methods	7 - 8
• Control of voltage level and frequency • Real and reactive power flow management • Economic dispatch techniques	9 - 10
• Review of course concepts • Case studies and practical applications • Final project presentations or assessments	11 - 12
Lecture free week	13
Revision & Examination	14-15

j) Method of Grading Continuous Assessment

Continuous Assessment (Assignments) – 20%
Continuous Assessment Test – 10%
End of Semester Examination – 70%

k) Tutorials

Tutorials will be taken at the end of each modules.

l) Term Paper and Assignments

Term Paper:
A well-structured term paper (10-15 pages) with proper referencing including relevant diagrams and figures calculations to support their explanation would be required of them at the beginning of module 3 (start of week 5) and expected to be turned in start of the Module 6 (start of week 11)
Assignments:
Two major assignments would be given on reactive compensation in power transmission systems, high voltage direct current transmission (HVDC) and/or alternating current (AC) transmission systems and Load Flow Analysis for a power system network.

m) Contemporary Issues and Industrial Relevance

- Grid modernization challenges: The integration of renewable energy sources and distributed generation into existing power grids poses challenges in grid stability, cybersecurity, and infrastructure upgrades to accommodate evolving technologies.
- Environmental sustainability: With growing concerns about climate change, industries are under pressure to adopt cleaner energy sources, driving the need for innovations in power system design, operation, and regulation to reduce carbon emissions and promote environmental sustainability.

Industrial Relevance:

- Reliability and resilience: Industries reliant on uninterrupted power supply, such as healthcare, telecommunications, and manufacturing, prioritize investments in power system reliability and resilience to minimize downtime and ensure operational continuity.
- Energy cost management: With energy costs being a significant operational expense, industries seek to optimize energy consumption, integrate energy-efficient technologies, and implement demand response strategies to mitigate costs and improve competitiveness in the market.

BOWEN UNIVERSITY, IWO
Faculty of Engineering
Department of Electrical/Electronic Engineering

Course Number: EEE 552
Course Title: Power Systems Engineering II
Semester: Second
Credit Hours: 2 hours
Contact Hours: Lecture - Two hours lectures per Week
Location: New Horizon
Lecturer(s): Prof. O. A. Komolafe & Mr. John Babalola

Textbooks and other Materials:

1. "Power System Analysis and Design" by *J. Duncan Glover, Mulukutla S. Sarma, and Thomas J. Overbye*
2. Power System Analysis" by *Hafi Sadat*
3. "Power System Analysis" by *John J. Grainger and William D. Stevenson, Jr.*

a) Course Overview and description

This is a continuation of EEE 551. The course is structured in such a way to foster in-depth understanding of Electrical Power System operations and management and their relation to power industries. Issues of Safety and Regulations of Electrical installation and operation were given in-depth consideration.

b) Pre-requisites: EEE 551

c) Co-requisite(s): New

d) Role in Curriculum: Elective

e) Course Learning Outcome (CLO) and Programme Outcomes (PO)

Course Learning Outcomes: upon successful completion of the course, students will be able to:	**Suitable Bloom Taxonomy Relevant to the CLOs**	**POs**	**Assessment Tools**
Analyze symmetrical and unsymmetrical faults in power systems and determine fault locations and determine fault currents using symmetrical components analysis techniques.	4	1, 2	Homework, quizzes and Exams
Use power system stability studies to evaluate the steady-state and transient stability power network stabilities. Evaluate the reliable and secure operation of the electrical grid.	3	1, 2, 7	Homework, quizzes and Exams
Outline the operating principles and constructional features of instruments transformers and relays used in power system protection. Evaluate network protection by studying the main and backup protection of units in a system	4	1, 6	Homework, quizzes and Exams
Assess over-voltage and insulation coordination in power systems, and selection of appropriate circuit breakers to mitigate over-voltage conditions and ensure system reliability.	6	3, 8	Homework, quizzes and Exams
Analyze load forecasting techniques and applications to system expansion planning	4	1, 2, 7 11	Homework, quizzes and Exams
Design specifications for energy system equipment, develop maintenance routines, and manage power stations to ensure efficient and reliable operation of energy systems.	5	3, 4, 9	Homework, quizzes and Exams

f) Mapping of CLOs to relevant POs

Course Learning Outcomes	Programme Outcomes											
	1	2	3	4	5	6	7	8	9	10	11	12
Analyze symmetrical and unsymmetrical faults in power systems and determine fault locations and determine fault currents using symmetrical components analysis techniques.	3	3										
Use power system stability studies to evaluate the steady-state and transient stability power network stabilities. Evaluate the reliable and secure operation of the electrical grid.	3	3					3					
Outline the operating principles and constructional features of instruments transformers and relays used in power system protection. Evaluate network protection by studying the main and backup protection of units in a system	3					3						
Assess over-voltage and insulation coordination in power systems, and selection of appropriate circuit breakers to mitigate over-voltage conditions and ensure system reliability.			3					3				
Analyze load forecasting techniques and applications to system expansion planning	3	3					3				3	
Design specifications for energy system equipment, develop maintenance routines, and manage power stations to ensure efficient and reliable operation of energy systems.			3	3					3			

Keys: 1 = Slightly related, 2 = Moderately related, 3= Highly related

g) Expectations of Students

a. Attend 2 hours of lectures per week

b. Turn in assignments and projects as considered suitable by the tutors

c. Complete continuous assessment which involves mid-semester test

d. Complete a 2-hour comprehensive final examination at the end of the semester.

h) Methods of Lecture Delivery/Teaching Aids

Lecture Delivery Methods

Educator-Student Interaction (Discussion method) Video Tutorials Electrical systems

Teaching Aids

Visual Aids (Use of PowerPoint slides, Lecture templates-handouts)

i) Course Content or Outline

Topics	Weeks
• Overview of symmetrical and unsymmetrical faults • Symmetrical components analysis • Fault current calculation techniques • Transient stability analysis	1 - 2
• Steady-state stability analysis • Factors affecting power system stability • Operating principles of relays • Constructional features of relays	3 - 4
• Analysis of pole alternators • Causes and effects of over-voltage in power systems • Insulation coordination techniques • Selection of circuit breakers for over-voltage protection	5 - 6
• Overview of national, continental, and global energy sources • Load forecasting techniques • Planning for generation, transmission, and loads	7 - 8
• Design specifications for energy system equipment • Development of maintenance routines • Management of power stations	9 - 10
• Review of course materials • Application of concepts through case studies and problem-solving exercises • Preparation for assessments and examinations	11 - 12
Lecture free week	13
Revision & Examination	14-15

j) Method of Grading Continuous Assessment

Continuous Assessment (Assignments): 20%
Continuous Assessment Test: 10%
End of Semester Examination: 70%

k) Tutorials

Tutorials will be taken at the end of each module.

l) Term Paper and Assignments

Term Paper:

A well-structured term paper (10-15 pages) with proper referencing including relevant diagrams and figures calculations to support their explanation would be required of them at the beginning of module 3 (start of week 5) and expected to be turned in start of the Module 6 (start of week 11)

Assignments:

Two major assignments would be given on symmetrical and unsymmetrical faults in power systems, transient stability analysis and steady-state stability analysis techniques in power systems and the role of relays in power system protection and their operating principles and applications.

m) Contemporary Issues and Industrial Relevance

- Grid modernization challenges: The integration of renewable energy sources and distributed generation into existing power grids poses challenges in grid stability, cybersecurity, and infrastructure upgrades to accommodate evolving technologies.

- Environmental sustainability: With growing concerns about climate change, industries are under pressure to adopt cleaner energy sources, driving the need for innovations in power system design, operation, and regulation to reduce carbon emissions and promote environmental sustainability.

Industrial Relevance:

- Reliability and resilience: Industries reliant on uninterrupted power supply, such as healthcare, telecommunications, and manufacturing, prioritize investments in power system reliability and resilience to minimize downtime and ensure operational continuity.

- Energy cost management: With energy costs being a significant operational expense, industries seek to optimize energy consumption, integrate energy-efficient technologies, and implement demand response strategies to mitigate costs and improve competitiveness.

BOWEN UNIVERSITY, IWO
Faculty of Engineering
Department of Electrical/Electronic Engineering

Course Number: EEE 553 **Course Title:** Electrical Energy Conversion and Storage
Semester: First **Credit Hours**: 2 hours
Contact Hours: Lecture - Two hours of lectures per Week.
Location: New Horizon **Lecturer(s)**: Dr. S. L Gbadamosi
Textbooks and other Materials:
[1] Energy Storage - Technologies and Applications by Ahmed Faheem Zobaa, InTech
[2] Fundamentals of Energy Storage by J. Jensen and B. Sorenson, Wiley-Interscalene, NewYork,
[3] Energy Storage: Fundamentals, Materials and Applications, by Huggins R. A., Springer.

a) Course Overview and description

This course provides a comprehensive examination of electromechanical energy conversion and diverse sources of motive power. Topics include traditional and renewable energy sources such as waste heat recovery, solar energy, nuclear power, wind, and geothermal energy. Additionally, the course covers primary and secondary cells, with a focus on batteries used in vehicles. Practical aspects like testing, fault diagnosis, repairs, and the impact of environmental factors on battery life are addressed. Students will also explore small-scale power sources, gaining insights into sustainable energy solutions.

b) Pre-requisites: Nil

c) Co-requisite(s): Nil

d) Role in Curriculum: Elective

e) Course Learning Outcome (CLO) and Programme Outcomes (PO)

Course Learning Outcomes: upon successful completion of the course, students will be able to:	**Suitable Bloom Taxonomy Relevant to the CLOs**	**POs**	**Assessment Tools**
Evaluate the concept and significance of waste heat recovery in energy generation and industrial processes.	6	3, 5, 7, 11	Homework, quizzes and Exams
Analyze the principles of solar energy, nuclear power, and other alternative energy sources, including their operational characteristics and environmental impacts.	4	2, 3, 7, 12	Homework, quizzes and Exams
Examine the principles of wind energy utilization, geothermal energy extraction, and the role of primary and secondary cells in energy storage systems.	2	5, 11	Homework, quizzes and Exams
Demonstrate knowledge of the design, operation, and characteristics of batteries used in vehicles and small-scale power applications.	3	2, 3, 5, 10	Homework, quizzes and Exams
Apply techniques for testing, fault diagnosis, and repairs of energy storage systems, including batteries and small-scale power sources.	4	5, 6, 8, 11	Homework, quizzes and Exams
Assess the impact of environmental factors on battery performance and explore strategies for enhancing battery life and efficiency.	6	7	Homework, quizzes and Exams
Develop skills in the selection, installation, and maintenance of small-scale power sources, considering environmental sustainability and energy efficiency principles.	5	2	Homework, quizzes and Exams

f) Mapping of CLOs to relevant POs

Course Learning Outcomes	Programme Outcomes											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Evaluate the concept and significance of waste heat recovery in energy generation and industrial processes.			3		2		2				3	
Analyze the principles of solar energy, nuclear power, and other alternative energy sources, including their operational characteristics and environmental impacts.		3	3				2					2
Examine the principles of wind energy utilization, geothermal energy extraction, and the role of primary and secondary cells in energy storage systems.					3						2	
Demonstrate knowledge of the design, operation, and characteristics of batteries used in vehicles and small-scale power applications.		2	2		3					2		
Apply techniques for testing, fault diagnosis, and repairs of energy storage systems, including batteries and small-scale power sources.					2	3		3			2	
Assess the impact of environmental factors on battery performance and explore strategies for enhancing battery life and efficiency.							2					
Develop skills in the selection, installation, and maintenance of small-scale power sources, considering environmental sustainability and energy efficiency principles.		**2**										

Keys: 1 = Slightly related, 2 = Moderately related, 3= Highly related

g) Expectations of Students

a. Attend 2 hours of lectures per week

b. Turn in assignments and projects as considered suitable by the tutors

c. Complete continuous assessment which involves mid-semester test

d. Complete a 2-hour comprehensive final examination at the end of the semester.

h) Methods of Lecture Delivery/Teaching Aids

Lecture Delivery Methods

Educator-Student Interaction (Discussion method) Video Tutorials Electrical systems

Teaching Aids

Visual Aids (Use of PowerPoint slides, Lecture templates-handouts)

i) Course Content or Outline

Topics	Weeks
Electromechanical Energy Conversion: Principles of electromechanical energy conversion, Types of energy conversion devices (e.g., generators, motors), Applications of electromechanical energy conversion in power systems.	1 - 2
Sources of Motive Power: Overview of different sources of motive power (e.g., fossil fuels, renewable energy), Comparison of energy sources in terms of efficiency and environmental impact, Role of motive power in various industries and transportation. Waste Heat Recovery: Importance of waste heat recovery in energy efficiency, Techniques and technologies for waste heat recovery, Applications of waste heat recovery in industrial processes and power generation.	3 - 5
Solar Energy: Principles of solar energy conversion, Types of solar energy technologies (e.g., photovoltaic cells, solar thermal systems), Applications of solar energy in electricity generation and heating. Nuclear Power: Basics of nuclear energy generation, nuclear reactor types and operation principles, Safety considerations and environmental impacts of nuclear power.	6 - 7
Other Sources of Energy: Wind energy, Wind turbine technology, wind farm operation, and environmental considerations, Geothermal energy: Geothermal power plants, heat extraction methods, and reservoir engineering. Biomass energy: Biomass conversion technologies, biofuels, and biogas production.	8 - 9
Energy Storage Technologies. Primary cells: Characteristics, types, and applications. Secondary cells (batteries): Battery chemistry, construction, and performance. Testing and characterization of batteries, Fault diagnosis and repair techniques for battery systems.	10
Environmental Factors and Battery Life: Impact of temperature, humidity, and cycling on battery performance, Strategies for optimizing battery life and reliability in different environmental conditions. Small-Scale Power Sources: Overview of microgrid and distributed energy resources, Applications of small-scale power sources in remote areas, off-grid systems, and portable devices	11 - 12
Lecture free week	13
Revision & Examination	14 - 15

j) Method of Grading Continuous Assessment

Continuous Assessment (Assignments): 20%
Continuous Assessment Test: 10%
End of Semester Examination: 70%

k) Tutorials

Tutorials will be taken at the end of each module.

l) Term Paper and Assignments

Assignments and other project work will be offered after each module.

m) Contemporary Issues and Industrial Relevance

- Sustainable Energy Transition: With the increasing focus on sustainability and reducing carbon emissions, there is a growing demand for electromechanical energy conversion technologies that utilize renewable energy sources such as solar, wind, and geothermal. Understanding these sources and their integration into power systems is crucial for addressing contemporary energy challenges.
- Decentralized Energy Systems: The shift towards decentralized energy systems, including small-scale power sources like microgrids and distributed generation technologies, presents new opportunities and challenges. Industrial relevance lies in the integration of these systems into existing power infrastructure to enhance resilience and reliability.
- Environmental Considerations and Regulatory Compliance: Industrial applications of electromechanical energy conversion technologies must adhere to stringent environmental regulations. Understanding the environmental impact of energy systems and implementing measures to mitigate adverse effects is critical for ensuring compliance and sustainability.
- Skills Development and Training: As industries evolve, there is a growing demand for skilled professionals capable of designing, implementing, and maintaining electromechanical energy conversion systems. Training programs that cover testing, fault diagnosis, repairs, and the latest technological advancements are essential for meeting industry needs and driving innovation.

BOWEN UNIVERSITY, IWO
Faculty of Engineering
Department of Electrical/Electronic Engineering

Course Number: EEE 554

Course Title: Electrical Machine III

Semester: Second

Credit Hours: 2

Contact Hours: Lecture - Two hours lectures per Week.

Location:

Lecturer(s): Dr. S. L. Gbadamosi

Textbooks and other Materials:

1. Lyshevski, Sergey Edward, Electromechanical systems, electric machines and applied mechatronics, CRC Press, 2018.
2. B. K. Bose, Power Electronic and Motor Drives: Advances and Trends, Academic Press, 2020.

a) Course Overview and description

This course provides a comprehensive study of electrical machines, focusing on poly-phase induction motors, synchronous machines, and induction machine dynamics. Students will explore the transient and steady-state behavior of electrical machines through the analysis of equivalent circuits and matrix equations. The course covers topics such as character and speed control of synchronous machines, saliency and d-q axis analysis, and the phenomena of synchronous oscillators. Additionally, students will delve into the analysis of synchronous machines transients, including sudden 3-phase short circuits and their transformation to d- and q-axis reference frames. The course also examines the dynamics of induction machines, including their performance during sudden load changes and 3-phase faults, as well as the effects of rotor resistances.

b) Pre-requisites: Nil

c) Co-requisite(s): Nil

d) Role in Curriculum: Elective

e) Course Learning Outcome (CLO) and Programme Outcomes (PO)

Course Learning Outcomes: upon successful completion of the course, students will be able to:	**Suitable Bloom Taxonomy Relevant to the CLOs**	**POs**	**Assessment Tools**
Analyze transient behavior in synchronous machines using mathematical models to simulate	4	5, 10	Homework, quizzes and Exams
Evaluate the behavior of synchronous machines during paralleling and the occurrence of sustained oscillations.	6	2	Homework, quizzes and Exams
Apply the transformation techniques to convert variables from the abc phase coordinate system to the d-q reference frame for analysis.	3	5	Homework, quizzes and Exams
Analyze the main dimensions and output equations to design transformers for specific applications.	4	2	Homework, quizzes and Exams
Assess the effectiveness of different control strategies for synchronous machines and induction motors	6	5	Homework, quizzes and Exams
Design innovative solutions for controlling the speed and characteristics of synchronous machines.	5	3	Homework, quizzes and Exams

f) Mapping of CLOs to relevant POs

Course Learning Outcomes	Programme Outcomes											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Analyze transient behavior in synchronous machines using mathematical models to simulate					3					2		
Evaluate the behavior of synchronous machines during paralleling and the occurrence of sustained oscillations.		3										
Apply the transformation techniques to convert variables from the abc phase coordinate system to the d-q reference frame for analysis.					2							
Analyze the main dimensions and output equations to design transformers for specific applications.		2										
Assess the effectiveness of different control strategies for synchronous machines and induction motors					3							
Design innovative solutions for controlling the speed and characteristics of synchronous machines.			2									

Keys: 1 = Slightly related, 2 = Moderately related, 3= Highly related

g) Expectations of Students

a. Attend 2 hours of lectures per week

b. Turn in assignments and projects as considered suitable by the tutors.

c. Complete continuous assessment which involves mid-semester test

d. Complete a 2-hour comprehensive final examination at the end of the semester.

h) Methods of Lecture Delivery/Teaching Aids

Lecture Delivery Methods

Educator-Student Interaction (Discussion method) Video Tutorials Electrical systems

Teaching Aids

Visual Aids (Use of PowerPoint slides, Lecture templates-handouts)

i) Course Content or Outline

Topics	Weeks
Fundamentals of electric machines: Magnetically coupled circuits, Electromechanical energy conversion. Machine windings and airgap MMF. Winding inductances and voltage equations. DC machines: operating characteristics and dynamic modeling: Voltage and torque equations. Types of DC machines. Dynamic characteristics. State equations, control system blocks.	1 - 3
Generalized reference-frame theory: Transformation equations. Commonly used references reference frames. Transformation of a balanced set. Balanced steady-state voltage equations. Variables observed from various reference frames. Symmetrical induction motors: Voltage and torque equations in machine variables. Voltage and torque equations in reference frames. Per-unit system. Free-acceleration and dynamic load regulation. Computer simulation	4 - 5
Synchronous machines: basics Voltage and torque equations in machine variables. Voltage and torque equations in arbitrary reference frames. Voltage and torque equations in rotor reference frames. Per-unit system. Free-acceleration and dynamic load regulation. Computer simulation. Transient stability limit and critical clearing time of three-phase fault. operational impedances Park's equations in operational form. Operational impedances. Standard machine reactance and time constants. Derived machine reactance and time constants. Parameters from frequency response characteristics.	6 - 8
Small signal modeling of induction and synchronous machines Linearization of machine equation. Eigen-value analysis. Transfer function models. Reduced-order modeling for induction and synchronous machines. Reduced-order equations. Large-excursion behavior predicted by Reduced-order equations. Linearized reduced-order equations. Eigenvalue analysis. Symmetrical and Unsymmetrical Two-Phase Induction Machines. Symmetrical two-phase induction machines. Voltage and torque equations in machine variables for unsymmetrical two-phase induction machines. Voltage and torque equations in stationary reference frame for unsymmetrical two-phase induction machines. Single-phase induction machines.	9 - 10
DC Machine Drives: Solid-state converters. AC-DC converter fed DC drives. One-quadrant DC-DC converter fed drive. Two-quadrant DC-DC converter fed drive. Four-quadrant DC-DC converter fed drive. Induction Motor Drives: V/f scalar control. Field-oriented control. Direct rotor field-oriented control. Indirect rotor field-oriented control. Brushless DC Motor Drives: Definition of brushless DC Motor. Square-wave brushless DC Motor. Sine-wave brushless DC Motor. Key issues for enhancing the driving performance of brushless DC Motor. Switched reluctance motors: Machine structure. The commonly used converters. Voltage and torque equations. Control approaches. Key issues for enhancing the driving performance of switched	11 - 12

reluctance motor drive.	
Lecture free week	13
Revision & Examination	14 - 15

j) Method of Grading Continuous Assessment

Continuous Assessment (Assignments and Project): 20%

Continuous Assessment (Test): 10%

End of Semester Examination :70%

k) Tutorials

Tutorials will be conducted at the end of each module.

l) Term Paper and Assignments

Assignments and other project work will be offered after each module.

m) Contemporary Issues and Industrial Relevance

- Energy Efficiency: With increasing emphasis on sustainability, industries are seeking energy-efficient electrical machines to reduce operational costs and minimize environmental impact.
- Smart Grid Technologies: The advent of smart grid technologies requires electrical machines with advanced control capabilities to ensure grid stability, reliability, and efficient energy management.
- Electrification of Transportation: The shift towards electric vehicles and electrified transportation systems necessitates the development of high-performance electrical machines for propulsion and charging infrastructure.
- Digital Twin Technology: Industries are increasingly adopting digital twin technology for predictive maintenance and optimization of electrical machines, requiring a deeper understanding of machine dynamics and behavior.

BOWEN UNIVERSITY, IWO
Faculty of Engineering
Department of Electrical/Electronic Engineering

Course Number: EEE 555 **Course Title:** Switchgear and High Voltage Engineering
Semester: Second **Credit Hours**: 2 hours
Contact Hours: Lecture - Two hours lectures per Week.
Location: New Horizon **Lecturer(s)**: Dr. S. L. Gbadamosi
Textbooks and other Materials:

1. M.S. Naidu and V. Kamaraju, High Voltage Engineering, Tata McGraw-Hill, 4th Edition, 2009.
2. Ravindranath, M.Chander, "Power System Protection and SwitchGear", Wiley Eastern Ltd. New Delhi

a) Course Overview and description

This course provides a comprehensive exploration of high voltage engineering, covering the generation, measurement, and applications of high voltage and current. Students will delve into breakdown theories for gaseous, liquid, and solid dielectrics, gaining insights into the principles underlying electrical breakdown phenomena. Additionally, the course addresses lightning phenomena, high voltage equipment, insulation coordination, lightning protection systems, electric cables, and capacitors.

b) Pre-requisites: Nil

c) Co-requisite(s): Nil

d) Role in Curriculum: Elective

e) Course Learning Outcome (CLO) and Programme Outcomes (PO)

Course Learning Outcomes: upon successful completion of the course, students will be able to:	**Suitable Bloom Taxonomy Relevant to the CLOs**	**POs**	**Assessment Tools**
Outline the principles and techniques involved in the generation and measurement of high voltage and current.	4	5, 6	Homework, quizzes and Exams
Analyze breakdown theories for gaseous, liquid, and solid dielectrics, including the factors influencing breakdown voltage.	4	2	Homework, quizzes and Exams
Evaluate the characteristics and applications of high voltage equipment, including transformers, circuit breakers, and insulators.	6	2, 5, 10	Homework, quizzes and Exams
Assess insulation coordination techniques to ensure the reliable operation of electrical systems under high voltage conditions.	6	5	Homework, quizzes and Exams
Apply safety measures and procedures in handling high voltage equipment and conducting high voltage experiments.	3	3	Homework, quizzes and Exams
Design and implement effective lightning protection systems for various types of structures and installations.	5	3, 5, 10	Homework, quizzes and Exams
Analyze the performance and reliability of electrical insulation systems in high voltage applications, considering environmental factors and aging effects.	4	2, 4, 5, 7, 11	Homework, quizzes and Exams

f) Mapping of CLOs to relevant POs

Course Learning Outcomes	Programme Outcomes											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Outline the principles and techniques involved in the generation and measurement of high voltage and current.					3	2						
Analyze breakdown theories for gaseous, liquid, and solid dielectrics, including the factors influencing breakdown voltage.		3										
Evaluate the characteristics and applications of high voltage equipment, including transformers, circuit breakers, and insulators.		3			2					2		
Assess insulation coordination techniques to ensure the reliable operation of electrical systems under high voltage conditions.					3							
Apply safety measures and procedures in handling high voltage equipment and conducting high voltage experiments.			3									
Design and implement effective lightning protection systems for various types of structures and installations.			2		2					3		
Analyze the performance and reliability of electrical insulation systems in high voltage applications, considering environmental factors and aging effects.		2		3	3		2				2	

Keys: 1 = Slightly related, 2 = Moderately related, 3= Highly related

g) Expectations of Students

a. Attend 2 hours of lectures per week

b. Turn in assignments and projects as considered suitable by the tutors

c. Complete continuous assessment which involves mid-semester test

d. Complete a 2-hour comprehensive final examination at the end of the semester.

h) Methods of Lecture Delivery/Teaching Aids

Lecture Delivery Methods

Educator-Student Interaction (Discussion method) Video Tutorials Electrical systems

Teaching Aids

Visual Aids (Use of PowerPoint slides, Lecture templates-handouts)

i) Course Content or Outline

Topics	Weeks
Conduction and breakdown in gases: Gases as insulating media, Ionisation processes. Townsend current growth equation. Current growth in the presence of secondary processes. Townsend’s criterion for breakdown. Experimental determination of ionization coefficients. Breakdown in electronegative gases, time lags for breakdown, streamer theory of breakdown in gases, Paschen’s law, Breakdown in non-uniform field and corona discharges, Post breakdown phenomena and applications, practical considerations in using gases for insulation purposes. .	1 - 3
Conduction and breakdown in liquid dielectrics: Pure liquids and commercial liquids, conduction and breakdown in pure liquids. Breakdown in solid dielectrics: Introduction, Intrinsic breakdown. Electromechanical breakdown, Thermal breakdown. Breakdown of solid dielectrics in practice.	4 - 5
Generation of high voltage and currents: Generation of high D.C, voltages, Generation of high alternating voltages, Generation of Impulse voltages. Tripping and control of impulse generators. Generation of Impulse currents. Measurements of high voltages and currents: Measurement of high D.C. voltages. Measurement of high D.C. and impulse voltages. Introduction. Measurement of high D.C. A.C. and impulse currents, cathode ray oscillographs for impulse voltages and currents measurements.	6 - 8
Circuit Breakers: Formation of arc during circuit breaking. Characteristics of electric arc. Theories of arc Interruption. Recovery and restriking voltage, interruption of capacitive and inductive currents. Current chopping. Principle of A.C. and D.C. circuit breaking requirements of good circuit breaker circuit breaker rating. Different types of circuit breakers. Air break and Air blast circuit breaker. Plain break and controlled break all circuit breakers. Minimum oil circuit breakers. Vacuum circuit breaker, SF6 circuit breaker. D.C. Circuit breaker. H.R.C. Fuse: Construction and characteristics	9 - 10
Nondestructive testing of materials and electrical apparatus: Introduction. Measurement of D.C. resistivity. Measurement of dielectric constant and loss factor. Partial discharge measurements. High voltage testing of electrical apparatus: Testing of insulators and bushings. Testing of isolators and circuit breakers, cables. Testing of transformers, surge diverter.	11-12
Lecture free week	13
Revision & Examination	14 -15

j) Method of Grading Continuous Assessment

Continuous Assessment (Assignment and Project): 20%
Continuous Assessment (Test): 10%
End of Semester Examination :70%

k) Tutorials

Tutorials will be conducted at the end of each module.

l) Term Paper and Assignments

Assignments and other project work will be offered after each module.

m) Contemporary Issues and Industrial Relevance

- Generation and Measurement of High Voltage and Current:
  With the increasing demand for high-powered electrical systems, there's a growing need for efficient methods of generating and measuring high voltage and current. Industries such as power generation, transmission, and distribution heavily rely on high voltage and current systems. Understanding how to efficiently generate and measure these parameters is crucial for ensuring the reliability and safety of electrical systems.
- Breakdown Theories for Gaseous, Liquid, and Solid Dielectrics:
  As electrical systems become more complex and operate at higher voltages, the risk of dielectric breakdown increases. Knowledge of breakdown theories is essential for designing insulation systems that can withstand high voltages without failure. This is critical in industries such as power generation, aerospace, and telecommunications.
- Lightning Phenomena:
  With climate change leading to more frequent and intense weather events, the risk of lightning strikes on electrical infrastructure is a growing concern. Understanding lightning phenomena is crucial for designing lightning protection systems to safeguard critical infrastructure such as power plants, communication towers, and substations.
- Lightning Protection:
  The increasing frequency of extreme weather events necessitates robust lightning protection measures to safeguard critical infrastructure. Industries with outdoor installations, such as power plants, wind farms, and oil refineries, require effective lightning protection systems to minimize the risk of damage and downtime caused by lightning strikes.

BOWEN UNIVERSITY, IWO
Faculty of Engineering
Department of Electrical/Electronic Engineering

Course Number: EEE 556 **Course Title:** Renewable energy
Semester: Second **Credit Hours**: 2 hours
Contact Hours: Lecture - Two hours lectures per Week.
Location: New Horizon **Lecturer(s)**: Dr. S. L. Gbadamosi
Textbooks and other Materials:
[1] D.P Kothari; K.C Singal; Rakesh Ranjan. Renewable Energy Sources and Technologies, 3rd Edition.

a) Course Overview and description

This course provides a comprehensive overview of electromechanical energy conversion and various sources of motive power. The course explores traditional and renewable energy sources, including waste heat recovery, solar energy, nuclear power, wind, and geothermal energy. Additionally, the course covers battery technologies, including primary and secondary cells, as well as their application in vehicles and small-scale power sources. Throughout the course, emphasis is placed on understanding energy conversion processes, environmental considerations, and emerging technologies in the field. Students will gain practical knowledge and skills in energy systems analysis, testing, fault diagnosis, and repairs.

b) Pre-requisites: Nil

c) Co-requisite(s): Nil

d) Role in Curriculum: Elective

e) Course Learning Outcome (CLO) and Programme Outcomes (PO)

Course Learning Outcomes: upon successful completion of the course, students will be able to:	**Suitable Bloom Taxonomy Relevant to the CLOs**	**POs**	**Assessment Tools**
Evaluate different sources of motive power used in electromechanical systems, including conventional and renewable energy sources.	6	3, 4	Homework, quizzes and Exams
Outline the fundamental concepts of solar energy, nuclear power, and other alternative sources of energy, including their generation mechanisms and potential applications.	4	1, 2, 3, 5, 10	Homework, quizzes and Exams
Evaluate the principles of wind energy and geothermal energy generation, including the design, operation, and environmental impact of wind turbines and geothermal power plants.	6	3, 5, 8, 10	Homework, quizzes and Exams
Analyze the principles and techniques involved in waste heat recovery systems to harness and utilize waste heat generated in industrial processes efficiently.	4	2, 5, 10, 11, 12	Homework, quizzes and Exams
Apply testing and diagnostic techniques to assess the performance and condition of batteries, including fault diagnosis and repair process	3	5	Homework, quizzes and Exams
Analyze the effects of environmental factors, such as temperature, humidity, and vibration, on battery life and performance, and implement strategies to mitigate these effects.	4	3, 7	Homework, quizzes and Exams
Design the operation of small-scale power sources, including microgrids, portable generators,	5	3, 10, 12	Homework, quizzes and Exams

and renewable energy systems, considering factors such as reliability, efficiency, and scalability.			

f) Mapping of CLOs to relevant POs

Course Learning Outcomes	Programme Outcomes										
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Evaluate different sources of motive power used in electromechanical systems, including conventional and renewable energy sources.			2	2								
Outline the fundamental concepts of solar energy, nuclear power, and other alternative sources of energy, including their generation mechanisms and potential applications.	3	2	2		3					3		
Evaluate the principles of wind energy and geothermal energy generation, including the design, operation, and environmental impact of wind turbines and geothermal power plants.			3		3		2			2		
Analyze the principles and techniques involved in waste heat recovery systems to harness and utilize waste heat generated in industrial processes efficiently.		3			3					2	2	3
Apply testing and diagnostic techniques to assess the performance and condition of batteries, including fault diagnosis					3							

and repair process												
Analyze the effects of environmental factors, such as temperature, humidity, and vibration, on battery life and performance, and implement strategies to mitigate these effects.			2				2					
Design the operation of small-scale power sources, including microgrids, portable generators, and renewable energy systems, considering factors such as reliability, efficiency, and scalability.			2							2		3

Keys: 1 = Slightly related, 2 = Moderately related, 3= Highly related

g) Expectations of Students

a. Attend 2 hours of lectures per week

b. Turn in assignments and projects as considered suitable by the tutors

c. Complete continuous assessment which involves mid-semester test

d. Complete a 2-hour comprehensive final examination at the end of the semester.

h) Methods of Lecture Delivery/Teaching Aids

Lecture Delivery Methods

Educator-Student Interaction (Discussion method) Video Tutorials Electrical systems

Teaching Aids

Visual Aids (Use of PowerPoint slides, Lecture templates-handouts)

i) Course Content or Outline

Topics	Weeks
Introduction to Renewable Energy and Energy Scenario Classification of Energy Sources, Energy resources (Conventional and nonconventional), Energy consumption patterns. Worldwide Potentials of these sources. Energy efficiency and energy security. Energy and its environmental impacts, Distributed generation.	1 - 2
Solar Energy: Solar thermal Systems: Types of collectors, Collection systems, efficiency calculations, applications. Photo voltaic (PV) technology: Present status, solar cells, cell technologies, characteristics of PV systems, equivalent circuit, array design, building integrated PV system, its components, sizing and economics. Peak power operation. Standalone and grid interactive systems.	3 - 4
Wind Energy: Wind speed and power relation, power extracted from wind, wind distribution and wind speed predictions. Wind power systems: system components, Types of Turbine, Turbine rating. Choice of generators, turbine rating, electrical load matching, Variable speed operation, maximum power operation, control systems, system design features, stand alone and grid connected operation. Small Hydro Systems.	5 - 6
Biomass: Biomass conversion, Combustion, Biogas, Biodiesel.	7
Energy Storage and Hybrid System Configuration: Energy storage, Battery – types, equivalent circuit, performance characteristics, battery design, charging and charge regulators. Battery management. Flywheel-energy relations, components, benefits over battery. Fuel Cell energy storage systems. Ultra Capacitors. Biomass and Biofuels.	8 - 9
Grid Integration: Standalone systems, Concept of Micro-Grid and its components, Hybrid systems – hybrid with diesel, with fuel cell, solar-wind, wind –hydro systems, mode controller, load sharing, system sizing. Hybrid system economics, Interface requirements, Stable operation, Transient-safety, Operating limits of voltage, frequency, stability margin, energy storage, and load scheduling. Effect on power quality, harmonic distortion, voltage transients and sags, voltage flickers, dynamic reactive power support. Systems stiffness.	10 - 12
Lecture free week	13
Revision & Examination	14 - 15

j) Method of Grading Continuous Assessment

Continuous Assessment (Assignments): 20%
Continuous Assessment Test: 10%
End of Semester Examination: 70%

k) Tutorials

Tutorials will be taken at the end of each module.

l) Term Paper and Assignments

Assignments and other project work will be offered after each module.

m) Contemporary Issues and Industrial Relevance

- Renewable Energy Integration: With increasing concerns about climate change and environmental sustainability, there is a growing emphasis on renewable energy sources such as solar, wind, and geothermal power. Understanding how to efficiently harness and integrate these renewable sources into the power grid is crucial for meeting energy demands while reducing carbon emissions.
- Energy Storage Solutions: As the demand for electric vehicles (EVs) and renewable energy systems rises, there is a pressing need for advanced energy storage technologies. Exploring primary and secondary cells, including deep cycle batteries, and understanding their testing, fault diagnosis, and repair processes are critical for ensuring reliable and efficient energy storage solutions in various industrial applications.
- Impact of Environmental Factors: Environmental factors significantly influence the performance and lifespan of energy storage systems, particularly batteries. Understanding the effects of temperature, humidity, and other environmental variables on battery life is crucial for designing resilient and long-lasting energy storage solutions for both stationary and mobile applications.
- Industrial Automation and IoT Integration: In industrial settings, there is a growing trend towards automation and the Internet of Things (IoT) for monitoring and controlling energy systems. Knowledge of small-scale power sources and their integration with IoT platforms enables efficient monitoring, predictive maintenance, and optimization of energy usage in industrial facilities.
- Regulatory Compliance and Safety Standards: Industrial applications of electromechanical energy conversion technologies are subject to stringent regulatory requirements and safety standards. Understanding and adhering to these standards is essential for ensuring workplace safety, environmental compliance, and the reliability of energy systems in industrial settings.

BOWEN UNIVERSITY, IWO
Faculty of Engineering
Department of Electrical/Electronic Engineering

Course Number: EEE 557 **Course Title:** Computer Application in Power Systems
Semester: First **Credit Hours**: 2 hours
Contact Hours: Lecture - Two hours lectures per Week
Location: **Lecturer(s)**: Prof. O. A. Komolafe
Mr. John Babalola

Textbooks and other Materials:

1. "Power System Analysis and Design" by J. Duncan Glover, Thomas J. Overbye, and Mulukutla S. Sarma
2. "Numerical Methods for Engineers" by Steven C. Chapra and Raymond P. Canale
3. MATLAB tutorials and exercises tailored to the course content, focusing on implementing numerical methods and analyzing power system data.

a) Course Overview and description

The course is structured in such a way to foster in-depth understanding of Electrical services and its relation to industries. Issues of Safety and Regulations of Electrical installations were given an in-depth consideration.

b) Pre-requisites:

c) Co-requisite(s): EEE 302

d) Role in Curriculum: Elective

e) Course Learning Outcome (CLO) and Programme Outcomes (PO)

Course Learning Outcomes: upon successful completion of the course, students will be able to:	**Suitable Bloom Taxonomy Relevant to the CLOs**	**Pos**	**Assessment Tools**
Analyze linear algebra concepts and numerical methods, including iterative techniques, Newton-Raphson method, and Gauss elimination method, to solve power system equations efficiently.	4	1, 2, 5	Homework, quizzes and Exams
Develop iterative methods such as Gauss-Seidel method to solve power flow and state estimation problems in power systems, considering convergence criteria and computational efficiency.	5	1, 3, 5, 8	Homework, quizzes and Exams
Analyze numerical integration techniques such as Euler method and Runge-Kutta 4th order method to solve power system dynamic behavior problems, considering accuracy and stability requirements.	4	1, 3, 5, 8	Homework, quizzes and Exams
Analyze the structure and properties of the node admittance matrix in power systems, including nodal analysis and network simplification techniques, to facilitate fault analysis.	4	1, 3, 4	Homework, quizzes and Exams
Develop algorithms for load flow analysis and state estimation in power systems, integrating node admittance matrix methods and numerical optimization techniques to determine system operating conditions and estimate system states.	5	1, 3, 4, 8	Homework, quizzes and Exams
Evaluate load forecasting techniques, including time series analysis and Kalman filter algorithms, to predict future power demand and optimize power system planning and operation.	6	1, 3, 4, 8	Homework, quizzes and Exams

f) Mapping of CLOs to relevant POs

Course Learning Outcomes	Programme Outcomes											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Analyze linear algebra concepts and numerical methods, including iterative techniques, Newton-Raphson method, and Gauss elimination method, to solve power system equations efficiently.	**3**	**2**			**2**							
Develop iterative methods such as Gauss-Seidel method to solve power flow and state estimation problems in power systems, considering convergence criteria and computational efficiency.	**3**		**3**		**3**			**3**				
Analyze numerical integration techniques such as Euler method and Runge-Kutta 4th order method to solve power system dynamic behavior problems, considering accuracy and stability requirements.	**3**		**3**		**3**			**3**				
Analyze the structure and properties of the node admittance matrix in power systems, including nodal analysis and network simplification techniques, to facilitate fault analysis.	**3**		**3**	**3**								
Develop algorithms for load flow analysis and state estimation in power systems, integrating node admittance matrix methods and numerical optimization techniques to determine system operating conditions and estimate system states.	**3**		**3**	**3**				**3**				
Evaluate load forecasting techniques, including time series analysis and Kalman filter algorithms, to predict future power demand and optimize power system planning and operation.	**3**		**3**	**3**				**3**				

Keys: 1 = Slightly related, 2 = Moderately related, 3= Highly related

g) Expectations of Students

a. Attend 2 hours of lectures per week

b. Turn in assignments and projects as considered suitable by the tutors

c. Complete continuous assessment which involves mid-semester test

d. Complete a 2-hour comprehensive final examination at the end of the semester.

h) Methods of Lecture Delivery/Teaching Aids

Lecture Delivery Methods

Educator-Student Interaction (Discussion method, Hands-on experience for MATLAB classes, One-on-One Consultations also available on request) Video Tutorials Electrical systems

Teaching Aids

Visual Aids (Use of PowerPoint slides, Lecture templates-handouts)

i) Course Content or Outline

Topics	Weeks
• Revision of linear algebra concepts • Overview of numerical methods • Iterative methods: Gauss-Seidel method, Newton-Raphson method • Application of numerical methods in power system analysis	1 - 2
• Introduction to numerical integration • Euler method for solving differential equations • Runge-Kutta 4th order method • Application of numerical integration in power system dynamics	3 - 4
• Introduction to power system node admittance matrix • Formation of node admittance matrix • Analysis of power system networks using node admittance matrix • Application of node admittance matrix in load flow analysis	5 - 6
• Load flow analysis techniques: Gauss elimination method, Gauss-Seidel method • State estimation in power systems • Techniques for solving load flow equations • Application of load flow analysis and state estimation in power system operation	7 - 8
v. Introduction to load forecasting vi. Time series analysis for load forecasting vii. Kalman filter for load forecasting viii. Application of load forecasting techniques in power system planning	9 - 10
• Introduction to MATLAB programming • Implementation of numerical methods and algorithms in MATLAB • Simulation of power system analysis techniques in MATLAB • Integration of MATLAB tools for power system analysis and visualization	11-12
Lecture free week	13
Revision & Examination	14 -15

j) Method of Grading Continuous Assessment

Continuous Assessment (Assignments) - 20%
Continuous Assessment Test - 10%
End of Semester Examination - 70%

k) Tutorials

Tutorials will be taken at the end of each module.

l) Term Paper and Assignments

Term Paper

A well-structured term paper (10-15 pages) with proper referencing including relevant diagrams and figures calculations to support their explanation would be required of them at the beginning of module 3 (beginning of week 5) and expected to be turned in end of the module 5 (End of week 10).

Assignments:

Three major assignments would be given on Numerical Methods in Power System Analysis, Fault Analysis, Load Forecasting Techniques and MATLAB Implementation of Power System Algorithms.

m) Contemporary Issues and Industrial Relevance

Renewable Energy Integration:

The integration of renewable energy sources like solar and wind power poses challenges in managing variability and uncertainty, necessitating advanced numerical methods for accurate prediction and optimization. Power system operators and renewable energy developers utilize numerical methods for load forecasting, grid modeling, and optimal power flow analysis, ensuring efficient integration of renewable energy resources and maintaining grid stability.

Smart Grid Development:

The evolution of smart grids necessitates advanced numerical methods for real-time data analysis, state estimation, and optimization of grid operations to address the demands of modern energy systems. Power utilities and grid operators leverage these techniques to enhance grid reliability, resilience, and efficiency by employing state estimation, fault detection, and demand response optimization in smart grid environments

BOWEN UNIVERSITY, IWO

Faculty of Engineering

Department of Electrical/Electronic Engineering

Course Number: EEE 558 **Course Title:** Power Systems Communication and Control

Semester: Second **Credit Hours**: 2 hours

Contact Hours: Lecture - Two hours lectures per Week.

Location: **Lecturer(s)**: Dr. S. L. Gbadamosi

Textbooks and other Materials:

[1] Akhtar Kalam and D. P Kothari "Power System Protection and Communications, 3rd Edition.

[2] Chakrabarti & Haldar, "Power System Analysis: Operation and Control", Prentice Hall of India, 2004 Edition.

[3] D.P. Kothari and I.J. Nagrath, 'Modern Power System Analysis', Third Edition, Tata McGraw Hill Publishing Company Limited, New Delhi, 2003.

a) Course Overview and Description

Communication and control of power systems encompass a broad and comprehensive spectrum, spanning various engineering disciplines from power system instrumentation to power system modeling and control systems theory. In the pursuit of managing and optimizing power system control and operation, information and control systems play integral roles across the entire power system. In fact, the integration of information and control systems with the physical power system is so seamless that they collectively form a cyber-physical system.

b) Pre-requisites: Nil

c) Co-requisite(s): Nil

d) Role in Curriculum: Elective

e) Course Learning Outcome (CLO) and Programme Outcomes (PO)

Course Learning Outcomes: upon successful completion of the course, students will be able to:	**Suitable Bloom Taxonomy Relevant to the CLOs**	**Pos**	**Assessment Tools**
Evaluate the principles and techniques involved in High Frequency (HF) communication over power lines.	6	5, 10, 11	Homework, quizzes and Exams
Analyze the operation of carrier systems and power-line carrier technologies.	4	2, 5, 10	Homework, quizzes and Exams
Assess the control mechanisms employed in power generation systems, including voltage control, frequency control, and methods to ensure system stability.	6	2, 8	Homework, quizzes and Exams
Evaluate the function and operation of automatic voltage regulators (AVR) and regulating transformers in maintaining optimal voltage levels in power systems.	6	5, 10	Homework, quizzes and Exams
Develop control strategies to regulate voltage and frequency in power generation systems, ensuring reliable and efficient operation.	5	1, 3, 5, 10	Homework, quizzes and Exams
Analyze real-world scenarios to identify potential issues related to voltage and frequency control and propose appropriate solutions to maintain system stability and reliability.	4	2, 3, 5, 6, 7, 10	Homework, quizzes and Exams

f) Mapping of CLOs to relevant POs

Course Learning Outcomes	Programme Outcomes											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Evaluate the principles and techniques involved in High Frequency (HF) communication over power lines.					3					2	3	
Analyze the operation of carrier systems and power-line carrier technologies.		3			3					2		
Assess the control mechanisms employed in power generation systems, including voltage control, frequency control, and methods to ensure system stability.		2						2				
Evaluate the function and operation of automatic voltage regulators (AVR) and regulating transformers in maintaining optimal voltage levels in power systems.					3					2		
Develop control strategies to regulate voltage and frequency in power generation systems, ensuring reliable and efficient operation.	2		2		3					3		
Analyze real-world scenarios to identify potential issues related to voltage and frequency control and propose appropriate solutions to maintain system stability and reliability.		2	2		3	3	2			2		

Keys: 1 = Slightly related, 2 = Moderately related, 3= Highly related

g) Expectations of Students

a. Attend 2 hours of lectures per week

b. Turn in assignments and projects as considered suitable by the tutors

c. Complete continuous assessment which involves mid-semester test

d. Complete a 2-hour comprehensive final examination at the end of the semester.

h) Methods of Lecture Delivery/Teaching Aids

Lecture Delivery Methods

Educator-Student Interaction (Discussion method) Video Tutorials Electrical systems

Teaching Aids

Visual Aids (Use of PowerPoint slides, Lecture templates-handouts)

i) **Course Content or Outline**

Topics	Weeks
Communications in Electric Power Systems: Introduction to Communications in Electric Power Systems, Overview of communication requirements. Communication basic concepts: impedance, propagation, reflection, attenuation Wave propagation models: transmission line equations, telegrapher's equations. Characteristics of transmission lines: impedance matching, standing waves, losses, High-Frequency Communication on Power Lines. Challenges and opportunities in utilizing power lines for communication, Signal attenuation, noise, and interference mitigation techniques. Case studies and real-world applications	1 - 2
Power Line Carrier System: Principles of carrier systems, Modulation techniques for power-line communication, Data transmission protocols and standards. Implementation considerations and performance evaluation. Multiplexing and Telemetering: Multiplexing techniques such as TDM, FDM, CDM, Remote measurement and monitoring with telemetering systems. Sensors, transducers, and communication protocols for telemetering. Case studies and practical applications. Signal Processing for Data Transmission: Introduction to digital signal processing (DSP), Filtering techniques for signal enhancement, Modulation/demodulation methods, Error correction and data compression algorithms.	3 - 4
Load Frequency Control: Basics of speed governing mechanism and modeling – speed - load characteristics – load sharing between two synchronous machines in parallel. Control area concept. Load Frequency Control of a single area system. Static and dynamic analysis of uncontrolled and controlled cases. Integration of economic dispatch control with LFC. Two - area system – modeling - static analysis of uncontrolled case - tie line with frequency bias control of two-area system - state variable model.	5 - 7
Reactive Power Voltage Control: Basics of reactive power control, Excitation systems – modelling. Static and dynamic analysis: stability compensation generation and absorption of reactive power. Methods of voltage control – tap changing transformer. System level control using generator voltage magnitude setting. Tap setting of OLTC transformer. MVAR injection of switched capacitors to maintain acceptable voltage profile and to minimize transmission loss.	8 - 9
Computer Control of Power Systems: Need for computer control of power systems. Concept of energy control center (or) load dispatch center and the functions – SCADA and EMS functions.	10 - 12
Lecture free week	13

Revision & Examination	14 - 15

j) Method of Grading Continuous Assessment

Continuous Assessment (Assignments): 20%
Continuous Assessment Test: 10%
End of Semester Examination: 70%

k) Tutorials

Tutorials will be taken at the end of each module.

l) Term Paper and Assignments

Assignments and other project work will be offered after each module.

m) Contemporary Issues and Industrial Relevance

The course addresses several contemporary issues and industrial relevance in the field of electrical engineering:

- Transmission Line Theory: Understanding transmission line theory is crucial for the efficient and reliable transfer of electrical energy over long distances. With the increasing demand for electricity and the expansion of power grids, optimizing transmission line performance becomes essential to minimize losses and ensure grid stability.
- High-Frequency (HF) Communication on Power Lines: In modern power systems, there is a growing interest in utilizing power lines for communication purposes, especially for smart grid applications. HF communication on power lines enables real-time monitoring and control of the grid, facilitating better management of power flow and fault detection.
- Carrier Systems and Power-Line Carrier Operation: Carrier systems allow for data transmission over power lines, enabling communication between substations, control centers, and distributed energy resources. Understanding the operation and optimization of power-line carrier systems is critical for implementing advanced grid control and automation techniques.
- Multiplexing, Telemetering, Signal Processing, and Data Transmission: The integration of multiplexing, telemetering, signal processing, and data transmission technologies enhances the capabilities of power systems monitoring and control. These techniques enable the collection, analysis, and interpretation of data from various sensors and devices deployed across the grid, facilitating predictive maintenance, and optimizing system performance.
- Control of Power Generation: As the energy landscape evolves with the integration of renewable energy sources and distributed generation, the control of power generation becomes increasingly complex. Voltage control is vital for maintaining grid stability and reliability, especially in systems with high penetrations of variable renewable energy.
- Automatic Voltage Regulators (AVR) and Regulating Transformers: Automatic voltage regulators and regulating transformers play a crucial role in maintaining voltage stability and ensuring consistent power quality. These devices adjust the voltage levels in response to load variations and disturbances, contributing to the overall stability of the power system.

BOWEN UNIVERSITY, IWO
Faculty of Engineering
Department of Electrical/Electronic Engineering

Course Number: EEE 599	**Course Title:** Assigned Project
Semester: First & Second	**Credit Hours**: 6
Contact Hours: 3 hours each per week	
Location: Supervisors, office	**Lecturer(s)**: All Lecturers

Textbooks and other Materials:
All relevant materials.

a) Course Overview and description

The undergraduate final year project serves as a culmination of students' academic journey, providing them with an opportunity to apply the knowledge and skills acquired throughout their undergraduate studies to tackle real-world problems or explore areas of interest within their field of study. Students are tasked with conceiving, planning, and executing a project under the guidance of faculty advisors. The project may involve conducting research, designing experiments, developing prototypes, or implementing solutions to practical challenges. The project's scope and objectives are defined in collaboration with faculty advisors, taking into account students' interests, academic goals, and available resources. Projects can vary widely in complexity, ranging from theoretical investigations to hands-on practical implementations.

b) Pre-requisites: Nil

c) Co-requisite(s): Nil

d) Role in Curriculum: Core

e) Course Learning Outcome (CLO) and Programme Outcomes (PO)

Course Learning Outcomes: upon successful completion of the course, students will be able to:	**Suitable Bloom Taxonomy Relevant to the CLOs**	**POs**	**Assessment Tools**
Identify a typical problem area of interest for an EEE final year project.	1	2	Homework, quizzes and Exams
Develop a project plan for the final year project.	5	11	Homework, quizzes and Exams
Demonstrate suitable research methodologies and tools for problem analysis and project development	3	4	Homework, quizzes and Exams
Outline project requirements into specifications or models and analyze the specifications or models and select suitable tools or methods for project development.	4	3	Homework, quizzes and Exams
Develop a system or theorem based on the stated specifications or models	5	3	Homework, quizzes and Exams
Evaluate the system or prove the theorem.	6	2, 5	Homework, quizzes and Exams
Justify with a formal report for project outcomes and results	6	10	

f) Mapping of CLOs to relevant POs

Course Learning Outcomes	**Programme Outcomes**											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Identify a typical problem area of interest for an EEE final year project.		3										
Develop a project plan for the final year project.											2	
Demonstrate suitable research methodologies and tools for problem analysis and project development				3								
Outline project requirements into specifications or models and analyze the specifications or models and select suitable tools or methods for project development.			2									
Develop a system or theorem based on the stated specifications or models			2									
Evaluate the system or prove the theorem.		3			3							
Justify with a formal report for project outcomes and results										3		

Keys: 1 = Slightly related, 2 = Moderately related, 3= Highly related

g) Expectations of Students

a. Attend 2 hours of lectures per week

b. Turn in assignments and projects as considered suitable by the tutors

c. Complete continuous assessment which involves mid-semester test

d. Complete a 2-hour comprehensive final examination at the end of the semester.

h) Methods of Lecture Delivery/Teaching Aids

Lecture Delivery Methods

Educator-Student Interaction (Discussion method) Video Tutorials Electrical systems

Teaching Aids

Visual Aids (Use of PowerPoint slides, Lecture templates-handouts)

i) Course Content or Outline

Each student is required to undertake a project that gives productivity value to the academic knowledge gained in his\her field of study. The project shall involve problem solving using engineering theories and techniques, and the implementation of the project design. The student is expected to design a possible solution to the problem, considering various aspects such as professionalism, economy, costing, and engineering viability. At the end of the first semester, each student shall present a seminar on his/her project. The project work is to be completed in this second phase. Each student is to submit a properly written report (banded 3 hardcopies, and a CD-ROM of electronic copy). The project is presented and defended at a seminar. Students may choose to work on individual design projects or team design projects. These projects consist of largely industry-sponsored projects as well as research projects proposed by academics. Students are supervised by the academic supervisor, the industrial mentor (in the case of industry sponsored projects) and supported by resources in the department. Students are responsible for organization, scheduling, budgeting, implementing, and time management, design outcome including prototypes, and reporting. This course lasts for one academic session. Each student must undertake a project under the supervision of a lecturer, submit a comprehensive project report and present a seminar at the end of the year. A project status report is to be presented at the end of the first semester. Each student must attend Engineering Seminars.

j) Method of Grading Continuous Assessment

Continuous Assessment (Attendance and Interaction): 30%

End of Semester Examination :70%

k) Tutorials

Problem encountered are discussed and solution preferred.

l) Term Paper and Assignments

Assignments and other project work will be offered after each module.

m) Contemporary Issues and Industrial Relevance

- Practical Application: Final year projects often involve solving real-world problems or addressing industry-specific challenges. By working on such projects, students gain hands-on experience in applying theoretical knowledge to practical scenarios, preparing them for the demands of the industry.
- Skill Development: Undertaking a final year project helps students develop a wide range of skills that are highly valued in the industry, including critical thinking, problem-solving, project management, teamwork, and communication. These skills are essential for success in professional roles and are sought after by employers.
- Innovation and Creativity: Many final year projects involve innovation and creativity, whether it's developing new technologies, improving existing processes, or finding novel solutions to industry challenges. This fosters an entrepreneurial mindset among students and prepares them to drive innovation in the industry.
- Collaboration with Industry Partners: Some final year projects may involve collaboration with industry partners, such as companies, research institutions, or governmental organizations. This collaboration provides students with exposure to real-world industry practices, access to industry expertise, and potential networking opportunities.
- Addressing Industry Needs: Final year projects can be tailored to address specific needs or interests of the industry. By focusing on relevant topics or areas of interest to the industry,

students can develop solutions that have practical applications and address current industry trends or challenges.

- Talent Pipeline: Industry partners often view final year projects as an opportunity to identify and recruit top talent. Students who excel in their final year projects demonstrate their capabilities and potential to prospective employers, increasing their employability and career prospects upon graduation.