Students' Handbook

Electrical and Electronics Engineering: Renewable Energy Option

Faculty of Engineering, Akpakip Oro University (AOU)

Academic year: [to be inserted]

Draft for Faculty approval

1. Welcome

Welcome to the Department of Electrical and Electronics Engineering. This handbook explains the Electrical and Electronics Engineering: Renewable Energy Option programme: what you will study, how you will be assessed, and where to get help. Read it alongside the university's academic regulations, which take precedence where they differ.

2. About the Programme

The programme trains engineers to design and operate electrical systems across power generation, transmission, distribution, electronics and renewable energy. Years 1 and 2 build the shared foundations in mathematics, physics, circuit theory and electromagnetics. Years 3 to 5 add power, control and the renewable energy specialisation, culminating in an integrated design project and defence.

Graduate profile

- Analyse and design electrical circuits, electronic systems, machines and power networks.
- Design renewable energy systems and their grid connection to applicable standards.
- Assess electrical safety, quality and standards.
- Consider sustainability, economics and policy in energy projects.
- Work ethically and communicate effectively in teams.

Career pathways

Graduates may work with power utilities and transmission and distribution companies, renewable energy developers, solar and wind installers, electrical consultancies, manufacturers and regulators. Graduates who register with COREN may practise as professional engineers in Nigeria. Postgraduate study is also an option.

Professional registration

Registration with the Council for the Regulation of Engineering in Nigeria (COREN) requires an accredited qualification and professional experience. Keep your SIWES records and project reports, as they support your later registration.

3. Programme Structure

The tables list every course, its units, the semester in which it is taken, and its track. Codes and units are provisional until confirmed in the approved CCMAS schedule.

Track: 'Core' is taken by all students. 'RE' marks courses in the Renewable Energy option.

Year 1: Engineering Foundations

Semester 1 (First semester)

Code	Course	Units	Track
EEE 101	Mathematics I	3	Core
EEE 102	General Physics I	3	Core
EEE 103	General Chemistry I	2	Core
EEE 104	Introductory Engineering	2	Core
EEE 105	Introduction to Computing	2	Core
EEE 106	Communication in English	2	Core
EEE 107	Engineering Laboratory Practicals	1	Core
EEE 108	Introduction to Electrical and Electronics Engineering	2	Core
	Semester total	**17**	

Semester 2 (Second semester)

Code	Course	Units	Track
EEE 109	Mathematics II	3	Core
EEE 110	General Physics II	3	Core
EEE 111	Engineering Drawing and Graphics	2	Core
EEE 112	Programming and Engineering Computation	2	Core
EEE 113	Nigerian Peoples and Cultures	2	Core
EEE 114	Physics Practicals	1	Core
EEE 115	Engineering Workshop and Safety	2	Core
EEE 116	Electrical Principles	3	Core
	Semester total	**18**	

Year 2: Core Engineering

Semester 3 (First semester)

Code	Course	Units	Track
EEE 201	Circuit Theory I	3	Core
EEE 202	Electronic Devices I	3	Core
EEE 203	Engineering Mathematics	3	Core
EEE 204	Electromagnetic Fields I	3	Core
EEE 205	Digital Logic Design	3	Core
EEE 206	Electrical Measurement and Instrumentation	2	Core
EEE 207	Engineering Mechanics: Statics	2	Core
EEE 208	Electrical Materials	2	Core
	Semester total	**21**	

Semester 4 (Second semester)

Code	Course	Units	Track
EEE 209	Circuit Theory II	3	Core
EEE 210	Electronic Devices II	3	Core
EEE 211	Numerical Methods for Engineers	3	Core
EEE 212	Signals and Systems I	3	Core
EEE 213	Digital Electronics	3	Core
EEE 214	Electrical Machines I	3	Core
EEE 215	Electrical Engineering Laboratory I	2	Core
EEE 216	Thermodynamics for Engineers	2	Core
	Semester total	**22**	

Year 3: Specialist Foundations

Semester 5 (First semester)

Code	Course	Units	Track
EEE 301	Signals and Systems II	3	Core
EEE 302	Analogue Electronics I	3	Core
EEE 303	Electrical Machines II	3	Core

Code	Course	Units	Track
EEE 304	Power Systems I	3	Core
EEE 305	Control Systems I	3	Core
EEE 306	Microprocessors and Microcontrollers	3	Core
EEE 307	Electrical Installation and Wiring	2	Core
EEE 308	Engineering Statistics and Research Methods	2	Core
	Semester total	**22**	

Semester 6 (Second semester)

Code	Course	Units	Track
EEE 309	Analogue Electronics II	3	Core
EEE 310	Power Electronics I	3	Core
EEE 311	Power Systems II	3	Core
EEE 312	Control Systems II	3	Core
EEE 313	Communication Systems I	3	Core
EEE 314	Renewable Energy Fundamentals	3	RE
EEE 315	Electrical Engineering Laboratory II	2	Core
EEE 316	Engineering Economics	2	Core
	Semester total	**22**	

Year 4: Advanced Design and Industrial Practice

Semester 7 (First semester)

Code	Course	Units	Track
EEE 401	Solar Photovoltaic Systems	3	RE
EEE 402	Wind Energy Systems	3	RE
EEE 403	Power Electronics II	3	Core
EEE 404	Power System Protection	3	Core
EEE 405	Power Systems Analysis	3	Core
EEE 406	Digital Signal Processing	3	Core
EEE 407	Instrumentation and Control Systems	2	Core
EEE 408	Research Project I	2	Core
	Semester total	**22**	

Semester 8 (Second semester)

Code	Course	Units	Track
EEE 409	Energy Storage and Battery Systems	3	RE
EEE 410	Hydro and Bioenergy Systems	2	RE
EEE 411	Grid Integration of Renewable Energy	3	RE
EEE 412	High Voltage Engineering	3	Core
EEE 413	Power Distribution and Substation Design	3	Core
EEE 414	Industrial Electrical Systems	2	Core
EEE 415	Electrical Systems Design and Standards	2	Core
EEE 416	Industrial Training (SIWES)	3	Core
	Semester total	**21**	

Year 5: Specialisation, Integration and Professional Readiness

Semester 9 (First semester)

Code	Course	Units	Track
EEE 501	Smart Grids and Microgrids	3	RE
EEE 502	Solar Energy Systems Design	3	RE
EEE 503	Renewable Energy Policy and Economics	2	RE
EEE 504	Power System Stability	3	Core
EEE 505	Advanced Power Electronics for Renewables	3	RE
EEE 506	Research Project II	3	Core
EEE 507	Engineering Project Management	2	Core
EEE 508	Technical Elective I	2	Core
	Semester total	**21**	

Semester 10 (Second semester)

Code	Course	Units	Track
EEE 509	Integrated Renewable Energy System Design	3	RE
EEE 510	Energy Efficiency and Auditing	2	RE
EEE 511	Environmental Impact and Sustainability	2	Core
EEE 512	Electrical Safety and Risk Management	2	Core
EEE 513	Engineering Professional Practice and Ethics	2	Core
EEE 514	Quality and Standards in Electrical Engineering	2	Core
EEE 515	Final-Year Design Project and Defence	4	Core
EEE 516	Technical Elective II	2	Core
	Semester total	**19**	

4. Course Specifications

Each entry gives the course description, learning outcomes, topics, assessment and recommended texts. Your lecturer issues the week-by-week scheme for each course.

Year 1: Engineering Foundations

EEE 101 Mathematics I

Units: 3 | Year 1, Semester 1 (First semester)

Description. Algebra, calculus and complex numbers for electrical engineers.

Learning outcomes:

- Solve algebraic and trigonometric problems
- Apply calculus to circuit and signal problems

Course topics:

1. Functions and graphs
2. Differentiation
3. Integration
4. Complex numbers

Assessment: CA 30 / Exam 70

Recommended texts: Stroud and Booth, Engineering Mathematics (latest edition)

EEE 102 General Physics I

Units: 3 | Year 1, Semester 1 (First semester)

Description. Mechanics, waves and thermal physics for engineers.

Learning outcomes:

- Analyse forces, motion and energy
- Apply conservation laws

Course topics:

1. Kinematics and dynamics
2. Work and energy
3. Rotation
4. Waves and oscillations

Assessment: CA 30 / Exam 70

Recommended texts: Halliday, Resnick and Walker, Fundamentals of Physics (latest edition)

EEE 103 General Chemistry I

Units: 2 | Year 1, Semester 1 (First semester)

Description. Atomic structure, bonding and chemical calculations relevant to materials and energy.

Learning outcomes:

- Explain atomic structure and bonding
- Perform stoichiometric calculations

Course topics:

1. Atomic structure
2. Bonding
3. Stoichiometry
4. Solutions

Assessment: CA 30 / Exam 70

Recommended texts: Chang and Goldsby, General Chemistry (latest edition)

EEE 104 Introductory Engineering

Units: 2 | Year 1, Semester 1 (First semester)

Description. Overview of engineering disciplines, problem solving and professional ethics.

Learning outcomes:

- Describe engineering disciplines
- Apply a structured problem-solving method

Course topics:

1. Disciplines and roles
2. Units and dimensions
3. Problem solving
4. Professional ethics

Assessment: CA 50 / Exam 50

Recommended texts: Dym and Little, Engineering Design (latest edition)

EEE 105 Introduction to Computing

Units: 2 | Year 1, Semester 1 (First semester)

Description. Computer fundamentals and productivity tools.

Learning outcomes:

- Use common computing tools
- Explain computer system components

Course topics:

1. Hardware
2. Operating systems
3. Productivity tools
4. Data management

Assessment: CA 60 / Exam 40

Recommended texts: Shelly and Vermaat, Discovering Computers (latest edition)

EEE 106 Communication in English

Units: 2 | Year 1, Semester 1 (First semester)

Description. Academic and technical writing and presentation.

Learning outcomes:

- Write clear technical reports
- Deliver structured presentations

Course topics:

1. Academic writing
2. Technical reports
3. Presentations
4. Listening and comprehension

Assessment: CA 60 / Exam 40

Recommended texts: Swales and Feak, Academic Writing for Graduate Students (latest edition)

EEE 107 Engineering Laboratory Practicals

Units: 1 | Year 1, Semester 1 (First semester)

Description. Introductory measurement, error analysis and laboratory safety.

Learning outcomes:

- Record and analyse measurement data
- Apply laboratory safety procedures

Course topics:

1. Units and measurement
2. Error analysis
3. Data presentation
4. Laboratory safety

Assessment: Lab reports 100

Recommended texts: Institutional laboratory manual

EEE 108 Introduction to Electrical and Electronics Engineering

Units: 2 | Year 1, Semester 1 (First semester)

Description. Scope of the discipline and its role in power, electronics and renewable energy.

Learning outcomes:

- Describe the main EEE subdisciplines
- Discuss energy and electronics careers

Course topics:

1. Subdisciplines
2. Power systems
3. Electronics and communications
4. Renewable energy and sustainability

Assessment: CA 40 / Exam 60

Recommended texts: Departmental reading list, to be confirmed

EEE 109 Mathematics II

Units: 3 | Year 1, Semester 2 (Second semester)

Description. Matrices, series, vectors and differential equations.

Learning outcomes:

- Solve linear systems
- Solve first and second order differential equations

Course topics:

1. Matrices
2. Vectors
3. Series
4. Differential equations

Assessment: CA 30 / Exam 70

Recommended texts: Stroud and Booth, Engineering Mathematics (latest edition)

EEE 110 General Physics II

Units: 3 | Year 1, Semester 2 (Second semester)

Description. Electricity, magnetism, optics and modern physics.

Learning outcomes:

- Analyse electric and magnetic fields
- Apply optics and modern physics concepts

Course topics:

1. Electrostatics
2. Magnetism
3. Optics
4. Modern physics

Assessment: CA 30 / Exam 70

Recommended texts: Halliday, Resnick and Walker (latest edition)

EEE 111 Engineering Drawing and Graphics

Units: 2 | Year 1, Semester 2 (Second semester)

Description. Orthographic projection and electrical and mechanical drawing conventions.

Learning outcomes:

- Produce orthographic drawings
- Apply electrical drawing symbols

Course topics:

1. Orthographic projection
2. Sections
3. Dimensioning
4. Electrical schematics

Assessment: Coursework 60 / Exam 40

Recommended texts: Giesecke et al., Technical Drawing (latest edition)

EEE 112 Programming and Engineering Computation

Units: 2 | Year 1, Semester 2 (Second semester)

Description. Structured programming and numerical methods.

Learning outcomes:

- Write structured programs for engineering problems
- Apply numerical methods

Course topics:

1. Programming basics
2. Control structures
3. Functions
4. Numerical methods

Assessment: CA 50 / Exam 50

Recommended texts: Chapra, Numerical Methods for Engineers (latest edition)

EEE 113 Nigerian Peoples and Cultures

Units: 2 | Year 1, Semester 2 (Second semester)

Description. Nigerian history, cultures and national development, or applicable general studies as prescribed.

Learning outcomes:

- Describe Nigerian cultural diversity
- Discuss national development issues

Course topics:

1. Nigerian history
2. Cultural diversity
3. Governance
4. Contemporary issues

Assessment: CA 40 / Exam 60

Recommended texts: Departmental reading list, to be confirmed

EEE 114 Physics Practicals

Units: 1 | Year 1, Semester 2 (Second semester)

Description. Laboratory experiments reinforcing physics theory.

Learning outcomes:

- Perform standard physics experiments
- Write accurate laboratory reports

Course topics:

1. Experimental methods
2. Measurement
3. Physics experiments
4. Report writing

Assessment: Lab reports 100

Recommended texts: Institutional laboratory manual

EEE 115 Engineering Workshop and Safety

Units: 2 | Year 1, Semester 2 (Second semester)

Description. Workshop practice, hand tools and electrical safety.

Learning outcomes:

- Use common workshop tools safely
- Apply electrical safety standards

Course topics:

1. Workshop safety
2. Hand tools
3. Electrical safety
4. Fabrication practice

Assessment: Practical 70 / Exam 30

Recommended texts: Institutional workshop manual

EEE 116 Electrical Principles

Units: 3 | Year 1, Semester 2 (Second semester)

Description. Basic DC and AC circuit analysis and electrical quantities.

Learning outcomes:

- Analyse resistive DC circuits
- Apply basic AC circuit concepts

Course topics:

1. DC circuits
2. Network theorems
3. AC fundamentals
4. Power and energy

Assessment: CA 30 / Exam 70

Recommended texts: Hughes, Electrical and Electronic Technology (latest edition)

Year 2: Core Engineering

EEE 201 Circuit Theory I

Units: 3 | Year 2, Semester 3 (First semester)

Description. Network analysis methods for linear circuits.

Learning outcomes:

- Apply nodal and mesh analysis
- Use network theorems

Course topics:

1. Nodal analysis
2. Mesh analysis
3. Network theorems
4. Transient response

Assessment: CA 30 / Exam 70

Recommended texts: Nilsson and Riedel, Electric Circuits (latest edition)

EEE 202 Electronic Devices I

Units: 3 | Year 2, Semester 3 (First semester)

Description. Semiconductor physics and diode circuits.

Learning outcomes:

- Explain semiconductor behaviour
- Analyse diode circuits

Course topics:

1. Semiconductor physics
2. PN junction
3. Diode circuits
4. Rectifiers

Assessment: CA 30 / Exam 70

Recommended texts: Boylestad and Nashelsky, Electronic Devices and Circuit Theory (latest edition)

EEE 203 Engineering Mathematics

Units: 3 | Year 2, Semester 3 (First semester)

Description. Partial derivatives, multiple integrals and Laplace transforms.

Learning outcomes:

- Apply Laplace transforms
- Solve partial differential problems

Course topics:

1. Partial derivatives
2. Multiple integrals
3. Laplace transforms
4. Fourier series

Assessment: CA 30 / Exam 70

Recommended texts: Kreyszig, Advanced Engineering Mathematics (latest edition)

EEE 204 Electromagnetic Fields I

Units: 3 | Year 2, Semester 3 (First semester)

Description. Static electric and magnetic fields.

Learning outcomes:

- Apply Coulomb's and Gauss's laws
- Apply Ampere's law

Course topics:

1. Electrostatics
2. Gauss's law
3. Magnetostatics
4. Ampere's law

Assessment: CA 30 / Exam 70

Recommended texts: Hayt and Buck, Engineering Electromagnetics (latest edition)

EEE 205 Digital Logic Design

Units: 3 | Year 2, Semester 3 (First semester)

Description. Boolean algebra and combinational and sequential logic.

Learning outcomes:

- Simplify Boolean functions
- Design combinational and sequential circuits

Course topics:

1. Boolean algebra
2. Combinational logic
3. Flip-flops
4. Counters and registers

Assessment: CA 40 / Exam 60

Recommended texts: Mano and Ciletti, Digital Design (latest edition)

EEE 206 Electrical Measurement and Instrumentation

Units: 2 | Year 2, Semester 3 (First semester)

Description. Measurement of electrical quantities and transducers.

Learning outcomes:

- Use measuring instruments correctly
- Analyse measurement uncertainty

Course topics:

1. Meters and bridges
2. Oscilloscope
3. Transducers
4. Uncertainty

Assessment: CA 40 / Exam 60

Recommended texts: Golding and Widdis, Electrical Measurements (latest edition)

EEE 207 Engineering Mechanics: Statics

Units: 2 | Year 2, Semester 3 (First semester)

Description. Force systems and equilibrium for mechanical and electrical installations.

Learning outcomes:

- Analyse equilibrium of bodies
- Determine forces in supports

Course topics:

1. Force systems
2. Equilibrium
3. Friction
4. Centroids

Assessment: CA 30 / Exam 70

Recommended texts: Hibbeler, Engineering Mechanics: Statics (latest edition)

EEE 208 Electrical Materials

Units: 2 | Year 2, Semester 3 (First semester)

Description. Conducting, insulating, magnetic and semiconducting materials.

Learning outcomes:

- Select materials for electrical applications
- Explain material properties

Course topics:

1. Conductors
2. Insulators
3. Magnetic materials
4. Semiconductors

Assessment: CA 40 / Exam 60

Recommended texts: Callister and Rethwisch, Materials Science and Engineering (latest edition)

EEE 209 Circuit Theory II

Units: 3 | Year 2, Semester 4 (Second semester)

Description. Frequency response, AC steady state and two-port networks.

Learning outcomes:

- Analyse AC steady state circuits
- Analyse two-port networks

Course topics:

1. Phasors
2. Power in AC circuits
3. Resonance
4. Two-port networks

Assessment: CA 30 / Exam 70

Recommended texts: Nilsson and Riedel (latest edition)

EEE 210 Electronic Devices II

Units: 3 | Year 2, Semester 4 (Second semester)

Description. Transistors and amplifier circuits.

Learning outcomes:

- Analyse BJT and FET amplifiers
- Design biasing circuits

Course topics:

1. BJT
2. FET
3. Biasing
4. Small-signal amplifiers

Assessment: CA 30 / Exam 70

Recommended texts: Boylestad and Nashelsky (latest edition)

EEE 211 Numerical Methods for Engineers

Units: 3 | Year 2, Semester 4 (Second semester)

Description. Numerical solution of engineering equations.

Learning outcomes:

- Apply numerical root finding and interpolation
- Solve ODEs numerically

Course topics:

1. Root finding
2. Interpolation
3. Numerical integration
4. ODE solvers

Assessment: CA 40 / Exam 60

Recommended texts: Chapra (latest edition)

EEE 212 Signals and Systems I

Units: 3 | Year 2, Semester 4 (Second semester)

Description. Continuous-time signals and linear systems.

Learning outcomes:

- Classify signals and systems
- Apply Fourier analysis

Course topics:

1. Signal classification
2. LTI systems
3. Convolution
4. Fourier series and transform

Assessment: CA 30 / Exam 70

Recommended texts: Oppenheim and Willsky, Signals and Systems (latest edition)

EEE 213 Digital Electronics

Units: 3 | Year 2, Semester 4 (Second semester)

Description. Logic families, memory and digital system design.

Learning outcomes:

- Compare logic families
- Design memory and interface circuits

Course topics:

1. Logic families
2. Memory
3. Interfacing
4. Timing

Assessment: CA 40 / Exam 60

Recommended texts: Floyd, Digital Fundamentals (latest edition)

EEE 214 Electrical Machines I

Units: 3 | Year 2, Semester 4 (Second semester)

Description. Transformers and DC machines.

Learning outcomes:

- Analyse transformer performance
- Analyse DC machine characteristics

Course topics:

1. Transformer theory
2. Transformer tests
3. DC generators
4. DC motors

Assessment: CA 30 / Exam 70

Recommended texts: Fitzgerald, Kingsley and Umans, Electric Machinery (latest edition)

EEE 215 Electrical Engineering Laboratory I

Units: 2 | Year 2, Semester 4 (Second semester)

Description. Practical circuit, electronics and machine experiments.

Learning outcomes:

- Carry out circuit and device tests
- Write technical lab reports

Course topics:

1. Circuit tests
2. Diode and transistor tests
3. Transformer tests
4. Reporting

Assessment: Lab reports 100

Recommended texts: Institutional laboratory manual

EEE 216 Thermodynamics for Engineers

Units: 2 | Year 2, Semester 4 (Second semester)

Description. Energy, heat and work for engineering systems.

Learning outcomes:

- Apply the first and second laws
- Analyse simple thermodynamic cycles

Course topics:

1. First law
2. Second law
3. Cycles
4. Heat transfer basics

Assessment: CA 40 / Exam 60

Recommended texts: Cengel and Boles, Thermodynamics (latest edition)

Year 3: Specialist Foundations

EEE 301 Signals and Systems II

Units: 3 | Year 3, Semester 5 (First semester)

Description. Sampling, z-transforms and discrete systems.

Learning outcomes:

- Apply sampling theory
- Analyse discrete systems using z-transforms

Course topics:

1. Sampling
2. Z-transforms
3. Discrete systems
4. Filter design basics

Assessment: CA 30 / Exam 70

Recommended texts: Oppenheim and Willsky (latest edition)

EEE 302 Analogue Electronics I

Units: 3 | Year 3, Semester 5 (First semester)

Description. Operational amplifiers and feedback circuits.

Learning outcomes:

- Analyse op-amp circuits
- Design feedback amplifiers

Course topics:

1. Op-amps
2. Feedback
3. Active filters
4. Oscillators

Assessment: CA 30 / Exam 70

Recommended texts: Sedra and Smith, Microelectronic Circuits (latest edition)

EEE 303 Electrical Machines II

Units: 3 | Year 3, Semester 5 (First semester)

Description. Induction and synchronous machines.

Learning outcomes:

- Analyse induction motor performance
- Analyse synchronous machine operation

Course topics:

1. Induction machines
2. Synchronous machines
3. Starting methods
4. Speed control

Assessment: CA 30 / Exam 70

Recommended texts: Fitzgerald et al. (latest edition)

EEE 304 Power Systems I

Units: 3 | Year 3, Semester 5 (First semester)

Description. Transmission line parameters and power flow fundamentals.

Learning outcomes:

- Calculate line parameters
- Analyse power flow basics

Course topics:

1. Line parameters
2. Transmission lines
3. Power flow
4. Per-unit system

Assessment: CA 30 / Exam 70

Recommended texts: Grainger and Stevenson, Power System Analysis (latest edition)

EEE 305 Control Systems I

Units: 3 | Year 3, Semester 5 (First semester)

Description. Modelling and time-domain analysis of control systems.

Learning outcomes:

- Derive transfer functions
- Analyse time response and stability

Course topics:

1. Transfer functions
2. Block diagrams
3. Time response
4. Stability

Assessment: CA 30 / Exam 70

Recommended texts: Ogata, Modern Control Engineering (latest edition)

EEE 306 Microprocessors and Microcontrollers

Units: 3 | Year 3, Semester 5 (First semester)

Description. Architecture and programming of microcontrollers.

Learning outcomes:

- Program microcontrollers in assembly and C
- Interface peripherals

Course topics:

1. Architecture
2. Assembly programming
3. C programming
4. Peripheral interfacing

Assessment: CA 40 / Exam 60

Recommended texts: Predko, Programming and Customizing the PIC Microcontroller (latest edition)

EEE 307 Electrical Installation and Wiring

Units: 2 | Year 3, Semester 5 (First semester)

Description. Domestic and industrial wiring, protection and earthing.

Learning outcomes:

- Design simple installation circuits
- Apply wiring regulations

Course topics:

1. Wiring systems
2. Protection devices
3. Earthing
4. Installation standards

Assessment: CA 40 / Exam 60

Recommended texts: Departmental reading list, to be confirmed

EEE 308 Engineering Statistics and Research Methods

Units: 2 | Year 3, Semester 5 (First semester)

Description. Statistics and research design for engineering.

Learning outcomes:

- Apply descriptive and inferential statistics
- Design simple experiments

Course topics:

1. Descriptive statistics
2. Probability
3. Hypothesis testing
4. Research design

Assessment: CA 40 / Exam 60

Recommended texts: Montgomery and Runger, Applied Statistics and Probability for Engineers (latest edition)

EEE 309 Analogue Electronics II

Units: 3 | Year 3, Semester 6 (Second semester)

Description. Power amplifiers and oscillators.

Learning outcomes:

- Design power amplifier stages
- Analyse oscillator circuits

Course topics:

1. Power amplifiers
2. Oscillators
3. Regulators
4. Filters

Assessment: CA 30 / Exam 70

Recommended texts: Sedra and Smith (latest edition)

EEE 310 Power Electronics I

Units: 3 | Year 3, Semester 6 (Second semester)

Description. Power semiconductor devices and AC-DC converters.

Learning outcomes:

- Analyse rectifiers and converters
- Select power semiconductor devices

Course topics:

1. Power devices
2. Rectifiers
3. Thyristor circuits
4. Converter analysis

Assessment: CA 30 / Exam 70

Recommended texts: Mohan, Undeland and Robbins, Power Electronics (latest edition)

EEE 311 Power Systems II

Units: 3 | Year 3, Semester 6 (Second semester)

Description. Fault analysis and symmetrical components.

Learning outcomes:

- Calculate symmetrical fault currents
- Apply symmetrical components

Course topics:

1. Symmetrical components
2. Fault analysis
3. Sequence networks
4. Short circuit studies

Assessment: CA 30 / Exam 70

Recommended texts: Grainger and Stevenson (latest edition)

EEE 312 Control Systems II

Units: 3 | Year 3, Semester 6 (Second semester)

Description. Frequency-domain design and state space.

Learning outcomes:

- Design compensators using frequency response
- Apply state-space methods

Course topics:

1. Frequency response
2. Bode plots
3. Compensator design
4. State space

Assessment: CA 30 / Exam 70

Recommended texts: Ogata (latest edition)

EEE 313 Communication Systems I

Units: 3 | Year 3, Semester 6 (Second semester)

Description. Analogue modulation and noise.

Learning outcomes:

- Analyse AM and FM systems
- Evaluate noise effects

Course topics:

1. AM
2. FM
3. Sampling and quantisation
4. Noise

Assessment: CA 30 / Exam 70

Recommended texts: Haykin, Communication Systems (latest edition)

EEE 314 Renewable Energy Fundamentals

Units: 3 | Year 3, Semester 6 (Second semester)

Description. Renewable resources, energy conversion and their economics.

Learning outcomes:

- Describe renewable energy resources
- Estimate energy yield

Course topics:

1. Solar resource
2. Wind resource
3. Hydro and biomass
4. Energy economics

Assessment: CA 40 / Exam 60

Recommended texts: Boyle, Renewable Energy (latest edition)

EEE 315 Electrical Engineering Laboratory II

Units: 2 | Year 3, Semester 6 (Second semester)

Description. Power, control and communication experiments.

Learning outcomes:

- Carry out power and control experiments
- Analyse experimental data

Course topics:

1. Power converters
2. Motor tests
3. Control experiments
4. Data analysis

Assessment: Lab reports 100

Recommended texts: Institutional laboratory manual

EEE 316 Engineering Economics

Units: 2 | Year 3, Semester 6 (Second semester)

Description. Economic evaluation of engineering projects.

Learning outcomes:

- Evaluate project cash flows
- Compare investment options

Course topics:

1. Time value of money
2. Cash flow
3. Depreciation
4. Project appraisal

Assessment: CA 40 / Exam 60

Recommended texts: Blank and Tarquin, Engineering Economy (latest edition)

Year 4: Advanced Design and Industrial Practice

EEE 401 Solar Photovoltaic Systems

Units: 3 | Year 4, Semester 7 (First semester)

Description. PV cell physics, modules, arrays and system design.

Learning outcomes:

- Model PV cells and arrays
- Size a stand-alone PV system

Course topics:

1. PV cell physics
2. I-V characteristics
3. Array design
4. Stand-alone systems

Assessment: CA 30 / Exam 70

Recommended texts: Messenger and Ventre, Photovoltaic Systems Engineering (latest edition)

EEE 402 Wind Energy Systems

Units: 3 | Year 4, Semester 7 (First semester)

Description. Wind resource, turbine aerodynamics and generators.

Learning outcomes:

- Estimate wind power output
- Analyse turbine performance

Course topics:

1. Wind resource
2. Aerodynamics
3. Turbine types
4. Generators and grid connection

Assessment: CA 30 / Exam 70

Recommended texts: Burton et al., Wind Energy Handbook (latest edition)

EEE 403 Power Electronics II

Units: 3 | Year 4, Semester 7 (First semester)

Description. DC-DC and DC-AC converters and inverters.

Learning outcomes:

- Analyse DC-DC converters
- Design inverter control

Course topics:

1. DC-DC converters
2. Inverters
3. PWM
4. Converter control

Assessment: CA 30 / Exam 70

Recommended texts: Mohan et al. (latest edition)

EEE 404 Power System Protection

Units: 3 | Year 4, Semester 7 (First semester)

Description. Protection schemes and relays.

Learning outcomes:

- Select protection schemes
- Coordinate protective devices

Course topics:

1. Protection principles
2. Relays
3. Coordination
4. Earthing

Assessment: CA 30 / Exam 70

Recommended texts: Blackburn and Domin, Protective Relaying (latest edition)

EEE 405 Power Systems Analysis

Units: 3 | Year 4, Semester 7 (First semester)

Description. Load flow and economic dispatch.

Learning outcomes:

- Solve load flow problems
- Apply economic dispatch

Course topics:

1. Load flow
2. Newton-Raphson
3. Economic dispatch
4. Losses

Assessment: CA 30 / Exam 70

Recommended texts: Grainger and Stevenson (latest edition)

EEE 406 Digital Signal Processing

Units: 3 | Year 4, Semester 7 (First semester)

Description. Discrete Fourier transform and digital filter design.

Learning outcomes:

- Apply the DFT
- Design digital filters

Course topics:

1. DFT and FFT
2. FIR filters
3. IIR filters
4. Applications

Assessment: CA 30 / Exam 70

Recommended texts: Proakis and Manolakis, Digital Signal Processing (latest edition)

EEE 407 Instrumentation and Control Systems

Units: 2 | Year 4, Semester 7 (First semester)

Description. Industrial instrumentation, sensors and control loops.

Learning outcomes:

- Select sensors and actuators
- Tune control loops

Course topics:

1. Sensors
2. Actuators
3. Process control
4. PID tuning

Assessment: CA 40 / Exam 60

Recommended texts: Bolton, Mechatronics (latest edition)

EEE 408 Research Project I

Units: 2 | Year 4, Semester 7 (First semester)

Description. Literature review and proposal for the final-year project.

Learning outcomes:

- Conduct a literature review
- Write a research proposal

Course topics:

1. Literature search
2. Research questions
3. Methodology
4. Proposal writing

Assessment: Proposal 100

Recommended texts: Supervisor guidance and departmental guide

EEE 409 Energy Storage and Battery Systems

Units: 3 | Year 4, Semester 8 (Second semester)

Description. Battery chemistries, storage sizing and management.

Learning outcomes:

- Size storage for renewable systems
- Analyse battery management

Course topics:

1. Battery chemistry
2. Sizing
3. Battery management
4. Safety

Assessment: CA 30 / Exam 70

Recommended texts: Linden and Reddy, Handbook of Batteries (latest edition)

EEE 410 Hydro and Bioenergy Systems

Units: 2 | Year 4, Semester 8 (Second semester)

Description. Small hydro and biomass energy conversion.

Learning outcomes:

- Assess small hydro potential
- Describe bioenergy conversion

Course topics:

1. Small hydro
2. Turbines
3. Biomass
4. Biogas

Assessment: CA 40 / Exam 60

Recommended texts: Departmental reading list, to be confirmed

EEE 411 Grid Integration of Renewable Energy

Units: 3 | Year 4, Semester 8 (Second semester)

Description. Connecting renewable generation to the grid.

Learning outcomes:

- Analyse grid-connection requirements
- Assess the impact of variable generation

Course topics:

1. Grid codes
2. Inverter interfacing
3. Voltage and frequency
4. Impact studies

Assessment: CA 30 / Exam 70

Recommended texts: Kirschen and Strbac, Fundamentals of Power System Economics (latest edition)

EEE 412 High Voltage Engineering

Units: 3 | Year 4, Semester 8 (Second semester)

Description. Insulation, breakdown and high-voltage testing.

Learning outcomes:

- Explain breakdown mechanisms
- Plan high-voltage tests

Course topics:

1. Insulation
2. Breakdown
3. Overvoltages
4. HV testing

Assessment: CA 30 / Exam 70

Recommended texts: Kuffel, Zaengl and Kuffel, High Voltage Engineering (latest edition)

EEE 413 Power Distribution and Substation Design

Units: 3 | Year 4, Semester 8 (Second semester)

Description. Distribution networks and substation layouts.

Learning outcomes:

- Design distribution feeders
- Lay out substations

Course topics:

1. Feeder design
2. Transformers
3. Substations
4. Earthing

Assessment: CA 30 / Exam 70

Recommended texts: Departmental reading list, to be confirmed

EEE 414 Industrial Electrical Systems

Units: 2 | Year 4, Semester 8 (Second semester)

Description. Motors, drives and power quality in industry.

Learning outcomes:

- Select motors and drives
- Assess power quality

Course topics:

1. Motor drives
2. Power factor correction
3. Power quality
4. Energy management

Assessment: CA 40 / Exam 60

Recommended texts: Departmental reading list, to be confirmed

EEE 415 Electrical Systems Design and Standards

Units: 2 | Year 4, Semester 8 (Second semester)

Description. Design of electrical systems to applicable standards.

Learning outcomes:

- Apply design standards
- Produce design calculations

Course topics:

1. Design standards
2. Load estimation
3. Cable sizing
4. Documentation

Assessment: CA 40 / Exam 60

Recommended texts: Departmental reading list, to be confirmed

EEE 416 Industrial Training (SIWES)

Units: 3 | Year 4, Semester 8 (Second semester)

Description. Supervised industrial attachment in a relevant organisation.

Learning outcomes:

- Apply engineering knowledge in practice
- Keep a professional logbook

Course topics:

1. Workplace induction
2. Practical tasks
3. Reporting
4. Professional conduct

Assessment: Logbook 40 / Report 40 / Assessor 20

Recommended texts: SIWES guidelines issued by the Industrial Training Fund and AOU

Year 5: Specialisation, Integration and Professional Readiness

EEE 501 Smart Grids and Microgrids

Units: 3 | Year 5, Semester 9 (First semester)

Description. Microgrid architecture, control and smart grid technologies.

Learning outcomes:

- Design microgrid architectures
- Apply microgrid control strategies

Course topics:

1. Microgrid architecture
2. Control
3. Communication
4. Smart metering

Assessment: CA 30 / Exam 70

Recommended texts: Departmental reading list, to be confirmed

EEE 502 Solar Energy Systems Design

Units: 3 | Year 5, Semester 9 (First semester)

Description. Design of grid-connected and off-grid solar systems.

Learning outcomes:

- Design grid-connected PV systems
- Design off-grid PV systems

Course topics:

1. Grid-connected design
2. Off-grid design
3. Energy yield
4. System economics

Assessment: Design project 60 / Exam 40

Recommended texts: Messenger and Ventre (latest edition)

EEE 503 Renewable Energy Policy and Economics

Units: 2 | Year 5, Semester 9 (First semester)

Description. Policy instruments, incentives and economic appraisal of renewables.

Learning outcomes:

- Evaluate policy instruments
- Appraise renewable projects economically

Course topics:

1. Policy instruments
2. Feed-in tariffs
3. Levelised cost
4. Project appraisal

Assessment: CA 40 / Exam 60

Recommended texts: Departmental reading list, to be confirmed

EEE 504 Power System Stability

Units: 3 | Year 5, Semester 9 (First semester)

Description. Transient and small-signal stability.

Learning outcomes:

- Analyse transient stability
- Assess small-signal stability

Course topics:

1. Rotor dynamics
2. Transient stability
3. Small-signal stability
4. Stability improvement

Assessment: CA 30 / Exam 70

Recommended texts: Kundur, Power System Stability and Control (latest edition)

EEE 505 Advanced Power Electronics for Renewables

Units: 3 | Year 5, Semester 9 (First semester)

Description. Converters for solar and wind integration.

Learning outcomes:

- Design converters for renewables
- Analyse grid-side control

Course topics:

1. Converter topologies
2. MPPT
3. Grid-side control
4. Thermal design

Assessment: CA 30 / Exam 70

Recommended texts: Mohan et al. (latest edition); departmental reading list

EEE 506 Research Project II

Units: 3 | Year 5, Semester 9 (First semester)

Description. Execution, analysis and reporting of the final-year project.

Learning outcomes:

- Execute a research project
- Report findings professionally

Course topics:

1. Data collection
2. Analysis
3. Writing
4. Oral presentation

Assessment: Project 100

Recommended texts: Supervisor guidance and departmental guide

EEE 507 Engineering Project Management

Units: 2 | Year 5, Semester 9 (First semester)

Description. Planning, scheduling and control of engineering projects.

Learning outcomes:

- Plan and schedule projects
- Manage cost and risk

Course topics:

1. Planning
2. Scheduling
3. Cost control
4. Risk

Assessment: CA 40 / Exam 60

Recommended texts: Departmental reading list, to be confirmed

EEE 508 Technical Elective I

Units: 2 | Year 5, Semester 9 (First semester)

Description. Elective from the approved renewable energy and power list.

Learning outcomes:

- Apply specialist knowledge in the chosen area
- Evaluate case studies

Course topics:

1. Selected topic
2. Case studies
3. Applications
4. Review

Assessment: CA 40 / Exam 60

Recommended texts: As specified for the chosen elective

EEE 509 Integrated Renewable Energy System Design

Units: 3 | Year 5, Semester 10 (Second semester)

Description. Capstone design of a hybrid renewable energy system.

Learning outcomes:

- Integrate generation, storage and grid interfaces
- Produce a coordinated design

Course topics:

1. System integration
2. Hybrid design
3. Storage sizing
4. Documentation

Assessment: Design project 100

Recommended texts: Departmental design brief

EEE 510 Energy Efficiency and Auditing

Units: 2 | Year 5, Semester 10 (Second semester)

Description. Energy audits and efficiency improvement.

Learning outcomes:

- Conduct energy audits
- Recommend efficiency measures

Course topics:

1. Energy audits
2. Metering
3. Efficiency measures
4. Reporting

Assessment: CA 40 / Exam 60

Recommended texts: Departmental reading list, to be confirmed

EEE 511 Environmental Impact and Sustainability

Units: 2 | Year 5, Semester 10 (Second semester)

Description. Environmental assessment of energy projects.

Learning outcomes:

- Assess environmental impacts
- Apply sustainability criteria

Course topics:

1. Impact assessment
2. Carbon accounting
3. Land use
4. Sustainability criteria

Assessment: CA 40 / Exam 60

Recommended texts: Departmental reading list, to be confirmed

EEE 512 Electrical Safety and Risk Management

Units: 2 | Year 5, Semester 10 (Second semester)

Description. Electrical safety, hazard analysis and risk control.

Learning outcomes:

- Apply electrical safety rules
- Conduct hazard analysis

Course topics:

1. Electrical hazards
2. Arc flash
3. Risk control
4. Safety management

Assessment: CA 40 / Exam 60

Recommended texts: Departmental reading list, to be confirmed

EEE 513 Engineering Professional Practice and Ethics

Units: 2 | Year 5, Semester 10 (Second semester)

Description. Professional conduct, registration and engineering law.

Learning outcomes:

- Apply professional ethics
- Describe registration and legal responsibilities

Course topics:

1. Ethics
2. Professional bodies
3. Registration
4. Engineering law

Assessment: CA 50 / Exam 50

Recommended texts: Departmental reading list, to be confirmed

EEE 514 Quality and Standards in Electrical Engineering

Units: 2 | Year 5, Semester 10 (Second semester)

Description. Quality management and standards for electrical equipment and installations.

Learning outcomes:

- Apply quality systems
- Use relevant standards

Course topics:

1. Quality systems
2. Testing standards
3. Certification
4. Documentation

Assessment: CA 40 / Exam 60

Recommended texts: Departmental reading list, to be confirmed

EEE 515 Final-Year Design Project and Defence

Units: 4 | Year 5, Semester 10 (Second semester)

Description. Culminating integrated design project with defence.

Learning outcomes:

- Produce a complete design project
- Defend design decisions orally

Course topics:

1. Design development
2. Documentation
3. Presentation
4. Defence

Assessment: Project 60 / Defence 40

Recommended texts: Departmental project guide

EEE 516 Technical Elective II

Units: 2 | Year 5, Semester 10 (Second semester)

Description. Second elective from the approved renewable energy and power list.

Learning outcomes:

- Apply specialist knowledge in the chosen area
- Evaluate case studies

Course topics:

1. Selected topic
2. Case studies
3. Applications
4. Review

Assessment: CA 40 / Exam 60

Recommended texts: As specified for the chosen elective

5. Industrial Training (SIWES)

- SIWES is taken in Year 4, Semester 8, for 3 units.
- Keep a daily or weekly logbook that records tasks, supervision and what you learned.
- Obtain the placement letter and supervisor details before you start.
- Your final report and assessor's evaluation are part of your assessment.
- Follow the Industrial Training Fund and AOU SIWES guidelines throughout.

6. Assessment and Academic Regulations

Assessment follows the university's approved academic regulations, which govern grading, attendance, progression, carry-over and classification. This summary does not replace those regulations.

- Continuous assessment (CA) is set by course. Examinations form the remainder unless a course states otherwise.
- Practical and laboratory courses are assessed on reports, practical work and, where stated, a viva.
- Design projects and the final-year defence are assessed by a panel using published rubrics.
- Report any missed assessment through the department as soon as possible, with supporting evidence.
- Grading and classification are as set out in the regulations: [insert AOU grading table].

7. Student Support and Conduct

- **Academic advising:** each student is assigned an adviser. Meet your adviser at least once a semester.
- **Academic integrity:** plagiarism, falsified data and unauthorised collaboration are serious offences.
- **Respect and inclusion:** treat staff, colleagues and communities with dignity; report harassment through the appropriate channel.
- **Wellbeing:** seek help early from your adviser or the university welfare services.

8. Laboratory, Workshop and Field Safety

- Wear the prescribed personal protective equipment (PPE) in laboratories, workshops and on sites.
- Follow the instructions of the technician and lecturer. Never operate equipment you have not been trained to use.
- Report every accident, near miss and damaged equipment immediately.
- Treat all electrical equipment as live until proven otherwise; follow lock-out and tag-out procedures.
- Never work alone on energised equipment, and use insulated tools and rated protective equipment.
- On solar and wind sites, follow height, rooftop and rigging safety rules.

9. Contacts

Role	Name	Contact
Head of Department	[to be inserted]	[to be inserted]
Programme coordinator	[to be inserted]	[to be inserted]
Level advisers	[to be inserted]	[to be inserted]
SIWES coordinator	[to be inserted]	[to be inserted]
Laboratory technical officer	[to be inserted]	[to be inserted]