Curriculum

Electrical and Electronics Engineering: Renewable Energy Option

Faculty of Engineering, Akpakip Oro University (AOU)

Curriculum document: draft for departmental, Faculty and Senate review

Course codes, units and status are provisional until reconciled with the NUC CCMAS

1. Preamble

This curriculum sets out the five-year Bachelor of Engineering programme in Electrical and Electronics Engineering: Renewable Energy Option, offered by the Department of Electrical and Electronics Engineering, Faculty of Engineering, Akpakip Oro University (AOU). It is designed to meet the NUC Core Curriculum and Minimum Academic Standards (CCMAS) and the professional requirements for engineering registration in Nigeria.

Course codes, units and compulsory or elective status are provisional and must be reconciled with the official CCMAS before Senate adoption. The CCMAS expansion used here should also be verified against the NUC publication.

2. Aims and Objectives

- Produce electrical and electronics engineers competent in power systems, power electronics, control and renewable energy.
- Build strong foundations in mathematics, physics, circuit theory and electromagnetics.
- Develop the design, standards, safety and sustainability skills needed for renewable energy projects.
- Prepare graduates for COREN registration and for employment or postgraduate study.

3. Graduate Competencies

On graduation, students should demonstrate competence in the areas below.

Competency	Expected graduate capability
Circuit and electronics analysis	Analyse linear circuits, electronic devices and amplifier circuits.
Power systems	Analyse power flow, faults, protection and stability of electrical networks.
Power electronics	Analyse and design converters and inverters for power conversion.
Control and instrumentation	Model, analyse and tune control systems and measurement instruments.
Renewable energy systems	Size and design solar, wind, hydro and bioenergy systems.
Energy storage and grid integration	Size storage and connect variable generation safely to the grid.
Electrical machines and drives	Analyse and select machines and drives for industrial and energy applications.
Design, standards and safety	Design electrical systems to standards and manage electrical hazards.
Sustainability and economics	Appraise renewable energy projects economically and assess their environmental impact.
Professional practice	Demonstrate ethical judgement, teamwork, communication and safety awareness.

4. Programme Structure

The programme comprises 80 courses and 205 units across ten semesters. The Track column shows whether a course is core (taken by all students) or belongs to a named option.

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

Code	Course	Units	Track
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
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

Code	Course	Units	Track
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**	

Units by year

Year	Level	Units
Year 1	100	35
Year 2	200	43
Year 3	300	44
Year 4	400	43
Year 5	500	40
Total		205

5. Option Emphasis

The Renewable Energy option differentiates Years 3 to 5. Renewable Energy Fundamentals is taken in Year 3, Semester 6. Option courses in Years 4 and 5 are: Solar Photovoltaic Systems; Wind Energy Systems; Energy Storage and Battery Systems; Hydro and Bioenergy Systems; Grid Integration of Renewable Energy; Smart

Grids and Microgrids; Solar Energy Systems Design; Renewable Energy Policy and Economics; Advanced Power Electronics for Renewables; Integrated Renewable Energy System Design; and Energy Efficiency and Auditing. All students take the core power, electronics and control courses.

6. Assessment Framework

The department uses a balanced assessment system. Exact weightings must be approved under the university's academic regulations and applicable programme standards.

Assessment method	Purpose
Written examinations	Test conceptual understanding and engineering analysis.
Assignments and problem sets	Assess calculations, design reasoning and independent learning.
Laboratory reports	Assess experimental method, data analysis and technical reporting.
Design projects	Assess engineering judgement, calculations, drawings and specifications.
Presentations and defences	Assess communication, teamwork and justification of technical decisions.
Industrial training	Assess workplace competence, professional conduct and practical experience.
Final-year project	Assess independent investigation and integrated engineering design.

7. Industrial Training and Projects

- **SIWES (Semester 8, 3 units):** supervised industrial attachment, assessed by logbook, report and assessor.
- **Research Project I and II (Semesters 7 and 9):** proposal, then execution and reporting.
- **Final-Year Design Project and Defence (Semester 10, 4 units):** integrated design with a formal defence.

8. Resource Requirements for Accreditation

The resource-verification file should document actual facilities, staff, maintenance and funding, not only proposed equipment.

- **Power and machines laboratory:** transformers, DC and AC machines, and power converter test equipment.
- **Renewable energy test facilities:** PV modules, I-V tracers, wind and hydro demonstration rigs.
- **Electronics laboratory:** oscilloscopes, signal generators, and development boards.
- **High-voltage facilities:** where available, or documented arrangements with partner laboratories.
- **Human resources:** qualified academic staff and technical staff with appropriate specialisms.
- **Library:** current textbooks, standards, technical journals and digital reference access.
- **Digital facilities:** software licences and computing infrastructure appropriate to the programme.
- **Industry partnerships:** employers, professional bodies and placement providers for SIWES.

9. Quality Assurance and CCMAS Alignment

- Map each course to the relevant NUC CCMAS course and learning outcomes.
- Verify course numbering, credit units, contact hours and prerequisites.
- Confirm the allocation of core and university-designed courses under the applicable CCMAS framework.
- Check professional requirements with COREN and other relevant accreditation bodies.
- Establish a curriculum review committee and an external academic review process.
- Submit the programme through the university's governance and regulatory approval processes.

10. Companion Documents

This curriculum is accompanied by the Students' Handbook, with full course specifications, and the Lecturers' Handbook, with teaching schemes, lab instructions, rubrics and assessment design.