Curriculum

Computer Engineering

Faculty of Engineering, Akpakip Oro University (AOU)

Curriculum document, with the Embedded Systems and Software and Networks options

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 Computer Engineering, offered by the Department of Computer 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 computer engineers who design hardware, embedded systems, software and networks as an integrated whole.
- Offer two pathways: Embedded Systems, for hardware-near and real-time systems, and Software and Networks, for distributed systems and network infrastructure.
- Build strong foundations in mathematics, digital electronics, algorithms and programming.
- 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
Programming and software	Write, test and maintain software using sound design and engineering practice.
Digital and computer architecture	Design digital circuits and analyse processor and memory organisation.
Electronics	Analyse circuits and semiconductor devices that underpin computing hardware.
Algorithms and data	Design efficient algorithms and data structures and manage data.
Operating systems and real-time systems	Explain operating system design and build systems with real-time constraints.
Embedded systems	Design hardware and firmware for embedded and real-time devices.
Networks and communications	Design, configure and analyse computer networks and distributed services.
Security and reliability	Apply security, testing and reliability methods to computing systems.
Design and integration	Integrate hardware and software into complete, tested systems.
Professional practice	Demonstrate ethical judgement, teamwork, communication and safety awareness.

4. Programme Structure

The programme comprises 80 courses and 207 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. 'ES' marks Embedded Systems option courses; 'SN' marks Software and Networks option courses.

Year 1: Engineering Foundations

Semester 1 (First semester)

Code	Course	Units	Track
CPE 101	Mathematics I	3	Core
CPE 102	Discrete Mathematics	3	Core
CPE 103	Introduction to Computing	2	Core
CPE 104	Programming I	3	Core

Code	Course	Units	Track
CPE 105	Communication in English	2	Core
CPE 106	Introductory Engineering	2	Core
CPE 107	Engineering Laboratory Practicals	1	Core
CPE 108	Introduction to Computer Engineering	2	Core
	Semester total	**18**	

Semester 2 (Second semester)

Code	Course	Units	Track
CPE 109	Mathematics II	3	Core
CPE 110	Physics for Electronics	3	Core
CPE 111	Programming II	3	Core
CPE 112	Computer Hardware Fundamentals	2	Core
CPE 113	Nigerian Peoples and Cultures	2	Core
CPE 114	Engineering Workshop and Safety	2	Core
CPE 115	Electrical Principles	3	Core
CPE 116	Computing Laboratory I	1	Core
	Semester total	**19**	

Year 2: Core Engineering

Semester 3 (First semester)

Code	Course	Units	Track
CPE 201	Data Structures and Algorithms	3	Core
CPE 202	Digital Logic Design	3	Core
CPE 203	Electronic Devices I	3	Core
CPE 204	Computer Organisation and Architecture	3	Core
CPE 205	Object-Oriented Programming	3	Core
CPE 206	Engineering Mathematics	3	Core
CPE 207	Probability and Statistics	2	Core
CPE 208	Circuit Theory I	3	Core
	Semester total	**23**	

Semester 4 (Second semester)

Code	Course	Units	Track
CPE 209	Operating Systems	3	Core
CPE 210	Digital Electronics	3	Core
CPE 211	Microprocessors	3	Core
CPE 212	Database Systems	3	Core
CPE 213	Software Engineering I	3	Core
CPE 214	Signals and Systems	3	Core
CPE 215	Computing Laboratory II	2	Core
CPE 216	Numerical Methods	2	Core
	Semester total	**22**	

Year 3: Specialist Foundations

Semester 5 (First semester)

Code	Course	Units	Track
CPE 301	Embedded Systems Design	3	ES
CPE 302	Computer Networks I	3	Core
CPE 303	Real-Time Systems	3	ES
CPE 304	Software Engineering II	3	Core
CPE 305	Microcontroller Interfacing	3	ES
CPE 306	Algorithms and Complexity	3	Core
CPE 307	Computer Architecture II	3	Core
CPE 308	Engineering Statistics and Research Methods	2	Core
	Semester total	**23**	

Semester 6 (Second semester)

Code	Course	Units	Track
CPE 309	Computer Networks II	3	SN
CPE 310	Embedded Linux and Device Drivers	3	ES
CPE 311	Network Programming	3	SN
CPE 312	Compiler Design	3	Core
CPE 313	Mobile Application Development	3	SN
CPE 314	Sensors and Actuators Interfacing	2	ES
CPE 315	Computing Laboratory III	2	Core
CPE 316	Engineering Economics	2	Core
	Semester total	**21**	

Year 4: Advanced Design and Industrial Practice

Semester 7 (First semester)

Code	Course	Units	Track
CPE 401	Internet of Things	3	ES
CPE 402	Wireless Sensor Networks	3	ES
CPE 403	Network Security	3	SN
CPE 404	Distributed Systems	3	SN
CPE 405	Machine Learning Fundamentals	3	Core
CPE 406	Hardware-Software Co-design	3	ES
CPE 407	Cloud Computing	2	SN
CPE 408	Research Project I	2	Core
	Semester total	**22**	

Semester 8 (Second semester)

Code	Course	Units	Track
CPE 409	Embedded Systems Security	2	ES
CPE 410	Network Design and Administration	3	SN
CPE 411	Industrial Embedded Systems	3	ES

Code	Course	Units	Track
CPE 412	Cybersecurity Operations	3	SN
CPE 413	Artificial Intelligence	3	Core
CPE 414	Digital Systems Verification	2	Core
CPE 415	Systems Design Standards	2	Core
CPE 416	Industrial Training (SIWES)	3	Core
	Semester total	**21**	

Year 5: Specialisation, Integration and Professional Readiness

Semester 9 (First semester)

Code	Course	Units	Track
CPE 501	Advanced Embedded Systems	3	ES
CPE 502	Advanced Network Systems	3	SN
CPE 503	Edge Computing and Embedded AI	2	ES
CPE 504	DevOps and Software Delivery	2	SN
CPE 505	Research Project II	3	Core
CPE 506	Engineering Project Management	2	Core
CPE 507	Technical Elective I	2	Core
CPE 508	Intellectual Property and IT Law	2	Core
	Semester total	**19**	

Semester 10 (Second semester)

Code	Course	Units	Track
CPE 509	Integrated Computing Systems Design	3	Core
CPE 510	Embedded Product Development	2	ES
CPE 511	Enterprise Network Deployment	2	SN
CPE 512	Engineering Professional Practice and Ethics	2	Core
CPE 513	Quality Assurance and Testing	2	Core
CPE 514	Risk and Safety in Computing Systems	2	Core
CPE 515	Final-Year Design Project and Defence	4	Core
CPE 516	Technical Elective II	2	Core
	Semester total	**19**	

Units by year

Year	Level	Units
Year 1	100	37
Year 2	200	45
Year 3	300	44
Year 4	400	43
Year 5	500	38
Total		207

5. Option Emphasis

Students choose a pathway in Year 3. Embedded Systems (ES) covers embedded architectures, real-time systems, firmware and Linux device drivers, sensor and actuator interfacing, IoT, wireless sensor networks, hardware-software co-design, embedded security and industrial embedded systems. Software and Networks (SN) covers network programming, distributed systems, network and cybersecurity, cloud computing, mobile applications, DevOps, and enterprise and advanced networks. The core in digital design, algorithms, operating systems, software engineering and project work is common to both pathways.

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.

- **Digital and microcontroller laboratory:** logic analysers, FPGA or development boards, and microcontroller kits.
- **Network laboratory:** managed switches, routers, and traffic capture tools on an isolated network.
- **Embedded development:** programmers, debuggers and single-board computers.
- **Cybersecurity laboratory:** an isolated environment for security exercises, with written authorisation for each exercise.
- **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.