Curriculum

Mechanical Engineering (Manufacturing and Production; Naval Architecture and Boat Building; Materials and Corrosion options)

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 Mechanical Engineering (Manufacturing and Production; Naval Architecture and Boat Building; Materials and Corrosion options), offered by the Department of Mechanical 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 mechanical engineers who design, manufacture and maintain machines, materials and vessels.
- Offer three options: Manufacturing and Production, with an Additive Manufacturing track; Naval Architecture and Boat Building; and Materials and Corrosion.
- Build strong foundations in mathematics, mechanics, thermal and fluid systems, and materials.
- 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
Mechanics and design	Analyse forces and stresses and design machine elements and assemblies.
Thermal and fluid systems	Analyse energy conversion, heat transfer and fluid machinery.
Materials	Select and characterise engineering materials for service conditions.
Manufacturing processes	Select and control casting, forming, machining, joining and additive processes.
Production systems	Plan, schedule and improve production and manufacturing systems.
Additive manufacturing	Design, build and qualify parts made by additive processes.
Corrosion and surface engineering	Assess corrosion, select protection methods and manage asset integrity.
Marine engineering	Assess stability, resistance and structure of ships and boats.
Measurement and quality	Measure, inspect and control the quality of engineering products.
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. 'MP' marks Manufacturing and Production option courses. 'AM' marks the Additive Manufacturing track, which sits within the Manufacturing and Production option. 'NA' marks Naval Architecture and Boat Building option courses. 'MC' marks Materials and Corrosion option courses.

Year 1: Engineering Foundations

Semester 1 (First semester)

Code	Course	Units	Track
MEC 101	Mathematics I	3	Core
MEC 102	General Physics I	3	Core
MEC 103	General Chemistry I	2	Core
MEC 104	Introductory Engineering	2	Core

Code	Course	Units	Track
MEC 105	Introduction to Computing	2	Core
MEC 106	Communication in English	2	Core
MEC 107	Engineering Laboratory Practicals	1	Core
MEC 108	Introduction to Mechanical Engineering	2	Core
	Semester total	**17**	

Semester 2 (Second semester)

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

Year 2: Core Engineering

Semester 3 (First semester)

Code	Course	Units	Track
MEC 201	Engineering Mechanics: Statics	3	Core
MEC 202	Strength of Materials I	3	Core
MEC 203	Engineering Mathematics	3	Core
MEC 204	Thermodynamics I	3	Core
MEC 205	Fluid Mechanics I	3	Core
MEC 206	Engineering Materials I	2	Core
MEC 207	Computer-Aided Design	2	Core
MEC 208	Manufacturing Processes I	3	Core
	Semester total	**22**	

Semester 4 (Second semester)

Code	Course	Units	Track
MEC 209	Engineering Mechanics: Dynamics	3	Core
MEC 210	Strength of Materials II	3	Core
MEC 211	Numerical Methods for Engineers	3	Core
MEC 212	Thermodynamics II	3	Core
MEC 213	Fluid Mechanics II	3	Core
MEC 214	Engineering Materials II	2	Core
MEC 215	Manufacturing Processes II	3	Core
MEC 216	Mechanical Engineering Laboratory I	2	Core
	Semester total	**22**	

Year 3: Specialist Foundations

Semester 5 (First semester)

Code	Course	Units	Track
MEC 301	Machine Design I	3	Core
MEC 302	Heat Transfer	3	Core
MEC 303	Engineering Metrology and Quality Control	3	Core
MEC 304	Machine Tools and Machining	3	Core
MEC 305	Materials Science and Metallurgy	3	Core
MEC 306	Engineering Statistics and Research Methods	2	Core
MEC 307	Control Systems Fundamentals	2	Core
MEC 308	Mechanical Engineering Laboratory II	2	Core
	Semester total	**21**	

Semester 6 (Second semester)

Code	Course	Units	Track
MEC 309	Machine Design II	3	Core
MEC 310	Fluid Machinery	3	Core
MEC 311	Corrosion Fundamentals	3	MC
MEC 312	Production Planning and Control	3	MP
MEC 313	Polymer and Composite Materials	3	MC
MEC 314	Joining and Welding Technology	3	MP
MEC 315	Computer-Aided Manufacturing	3	MP
MEC 316	Engineering Economics	2	Core
	Semester total	**23**	

Year 4: Advanced Design and Industrial Practice

Semester 7 (First semester)

Code	Course	Units	Track
MEC 401	Advanced Manufacturing Processes	3	MP
MEC 402	Additive Manufacturing Fundamentals	3	AM
MEC 403	Design for Manufacturing and Assembly	3	MP
MEC 404	Naval Architecture I: Hydrostatics and Stability	3	NA
MEC 405	Electrochemistry and Corrosion Control	3	MC
MEC 406	Finite Element Methods	3	Core
MEC 407	Lean Manufacturing and Operations	2	MP
MEC 408	Research Project I	2	Core
	Semester total	**22**	

Semester 8 (Second semester)

Code	Course	Units	Track
MEC 409	Additive Manufacturing Processes and Materials	3	AM
MEC 410	Additive Manufacturing Design and Post-processing	2	AM
MEC 411	Ship Resistance and Propulsion	3	NA

Code	Course	Units	Track
MEC 412	Marine Structures and Boat Construction	3	NA
MEC 413	Surface Engineering and Protective Coatings	3	MC
MEC 414	Failure Analysis and Materials Degradation	3	MC
MEC 415	Automation in Manufacturing	2	MP
MEC 416	Industrial Training (SIWES)	3	Core
	Semester total	**22**	

Year 5: Specialisation, Integration and Professional Readiness

Semester 9 (First semester)

Code	Course	Units	Track
MEC 501	Advanced Additive Manufacturing	3	AM
MEC 502	Additive Manufacturing Quality and Certification	2	AM
MEC 503	Ship Design Project	3	NA
MEC 504	Seakeeping and Ship Motions	3	NA
MEC 505	Advanced Corrosion Engineering	3	MC
MEC 506	Advanced Materials Selection	2	MC
MEC 507	Research Project II	3	Core
MEC 508	Technical Elective I	2	Core
	Semester total	**21**	

Semester 10 (Second semester)

Code	Course	Units	Track
MEC 509	Integrated Mechanical Systems Design	3	Core
MEC 510	Manufacturing Systems Design	2	MP
MEC 511	Marine Vessel Construction and Survey	2	NA
MEC 512	Asset Integrity and Corrosion Management	2	MC
MEC 513	Engineering Professional Practice and Ethics	2	Core
MEC 514	Environmental Impact and Sustainability	2	Core
MEC 515	Final-Year Design Project and Defence	4	Core
MEC 516	Technical Elective II	2	Core
	Semester total	**19**	

Units by year

Year	Level	Units
Year 1	100	35
Year 2	200	44
Year 3	300	44
Year 4	400	44
Year 5	500	40
Total		207

5. Option Emphasis

Students choose one of three options in Year 3, Semester 6, and take its courses in Years 4 and 5. Manufacturing and Production (MP) covers production planning, CNC and computer-aided manufacturing, welding and advanced processes, design for manufacture, lean operations, automation and manufacturing systems design. The Additive Manufacturing (AM) track sits within this option and covers additive process fundamentals, materials, design and post-processing, metal additive manufacturing, and quality and certification. Naval Architecture and Boat Building (NA) covers hydrostatics and stability, ship resistance and propulsion, marine structures and boat construction, seakeeping, ship design and vessel survey. Materials and Corrosion (MC) covers corrosion mechanisms and control, polymers and composites, surface engineering, failure analysis, advanced materials selection and asset integrity. Core courses in mechanics, thermal and fluid systems, machine design, materials and project work are common to all students.

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.

- **Materials laboratory:** tensile, hardness and impact testing; metallography; corrosion test facilities.
- **Manufacturing workshop:** lathes, milling machines, grinders, welding bays and CNC equipment.
- **Additive manufacturing facility:** FDM and resin printers, post-processing equipment, and a measurement station.
- **Thermo-fluids laboratory:** heat transfer, pipe flow and fluid machinery test rigs.
- **Marine facilities:** hydrostatics demonstration, a towing or wave tank where available, and boat-building workshop space.
- **Metrology:** coordinate measuring, surface roughness and dimensional measurement equipment.
- **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.