Civil Engineering Curriculum

Civil Engineering: Railway, Tunnel and Transport Infrastructure 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 Civil Engineering with the Railway, Tunnel and Transport Infrastructure option, offered by the Department of Civil 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.

This document replaces the earlier draft, which gave the expansion of CCMAS incorrectly. The expansion used here should be verified against the NUC publication before Senate adoption. Course codes, units and compulsory or elective status are provisional and must be reconciled with the official CCMAS.

2. Aims and Objectives

- Produce engineers competent in planning, designing, constructing and maintaining railways, tunnels and transport infrastructure.
- Build strong foundations in mathematics, the physical sciences, mechanics and materials.
- Develop professional practice, ethics, safety and sustainability awareness.
- 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
Engineering science	Apply mathematics, mechanics, physics and materials science to civil engineering problems.
Structural design	Analyse and design structures using applicable codes and engineering methods.
Geotechnical engineering	Investigate soils, assess foundations and evaluate ground stability.
Highway engineering	Design road alignments, pavement structures, drainage and intersections.
Railway engineering	Design track geometry, railway formation, drainage, earthworks and track infrastructure.
Tunnel engineering	Assess ground conditions and select tunnel construction methods, support systems and safety measures.
Construction management	Plan work, estimate costs, manage quality and monitor construction progress.
Sustainability	Assess environmental impact, climate resilience, resource efficiency and infrastructure durability.
Digital engineering	Use CAD, surveying, modelling, GIS and engineering analysis tools.
Professional practice	Demonstrate ethical judgement, teamwork, communication and safety awareness.

4. Programme Structure

The programme comprises 80 courses and 198 units across ten semesters. Each year is shown below with its semester totals.

Year 1: Engineering Foundations (100 Level)

Semester 1 (First semester)

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

Code	Course	Units
CVE 105	Introduction to Computing	2
CVE 106	Communication in English	2
CVE 107	Engineering Laboratory Practicals	1
CVE 108	Introduction to Civil Engineering	2
	Semester total	**17**

Semester 2 (Second semester)

Code	Course	Units
CVE 109	Mathematics II	3
CVE 110	General Physics II	3
CVE 111	General Chemistry II	2
CVE 112	Engineering Drawing and Graphics	2
CVE 113	Programming and Engineering Computation	2
CVE 114	Nigerian Peoples and Cultures	2
CVE 115	Physics and Chemistry Practicals	1
CVE 116	Engineering Workshop and Safety	2
	Semester total	**17**

Year 2: Core Civil Engineering (200 Level)

Semester 3 (First semester)

Code	Course	Units
CVE 201	Engineering Mechanics: Statics	3
CVE 202	Strength of Materials I	3
CVE 203	Engineering Surveying I	3
CVE 204	Civil Engineering Drawing and CAD	2
CVE 205	Fluid Mechanics I	3
CVE 206	Building and Construction Technology	2
CVE 207	Engineering Materials	2
CVE 208	Engineering Mathematics	3
	Semester total	**21**

Semester 4 (Second semester)

Code	Course	Units
CVE 209	Engineering Mechanics: Dynamics	3
CVE 210	Strength of Materials II	3
CVE 211	Engineering Surveying II	3
CVE 212	Engineering Geology	2
CVE 213	Fluid Mechanics II	3
CVE 214	Soil Mechanics I	3
CVE 215	Structural Analysis I	3
CVE 216	Introduction to Transportation Engineering	2
	Semester total	**22**

Year 3: Transport and Infrastructure Engineering (300 Level)

Semester 5 (First semester)

Code	Course	Units
CVE 301	Structural Analysis II	3
CVE 302	Soil Mechanics II	3
CVE 303	Highway Engineering I	3
CVE 304	Transportation Engineering	2
CVE 305	Engineering Surveying and Setting Out	2
CVE 306	Geotechnical Engineering	3
CVE 307	Construction Engineering	2
CVE 308	Engineering Statistics and Research Methods	2
	Semester total	**20**

Semester 6 (Second semester)

Code	Course	Units
CVE 309	Reinforced Concrete Design I	3
CVE 310	Foundation Engineering	3
CVE 311	Highway Engineering II	3
CVE 312	Pavement Materials and Asphalt Technology	2
CVE 313	Engineering Hydrology	2
CVE 314	Highway Drainage and Erosion Control	2
CVE 315	Railway Engineering I	3
CVE 316	Tunnel Engineering Fundamentals	3
	Semester total	**21**

Year 4: Advanced Design and Industrial Practice (400 Level)

Semester 7 (First semester)

Code	Course	Units
CVE 401	Reinforced Concrete Design II	3
CVE 402	Steel Structures	3
CVE 403	Highway Geometric Design	3
CVE 404	Railway Engineering II	3
CVE 405	Traffic Engineering and Road Safety	2
CVE 406	Construction Project Management	2
CVE 407	Environmental Engineering	2
CVE 408	Research Project I	2
	Semester total	**20**

Semester 8 (Second semester)

Code	Course	Units
CVE 409	Bridge Engineering	3
CVE 410	Advanced Pavement Design	3
CVE 411	Road Construction and Maintenance	2

Code	Course	Units
CVE 412	Tunnel Construction and Support Systems	3
CVE 413	Transportation Infrastructure Planning	2
CVE 414	Construction Contracts and Cost Estimation	2
CVE 415	Infrastructure Asset Management	2
CVE 416	Industrial Training (SIWES)	3
	Semester total	**20**

Year 5: Specialisation, Integration and Professional Readiness (500 Level)

Semester 9 (First semester)

Code	Course	Units
CVE 501	Advanced Highway Design	3
CVE 502	Highway Rehabilitation and Asset Management	2
CVE 503	Advanced Geotechnical Engineering	3
CVE 504	Sustainable and Climate-Resilient Infrastructure	2
CVE 505	Pavement Evaluation and Quality Control	2
CVE 506	Transport Infrastructure Economics	2
CVE 507	Research Project II	3
CVE 508	Technical Elective I	2
	Semester total	**19**

Semester 10 (Second semester)

Code	Course	Units
CVE 509	Integrated Transport Infrastructure Design	3
CVE 510	Railway and Highway Systems Integration	3
CVE 511	Advanced Bridge or Tunnel Design	3
CVE 512	Infrastructure Risk and Safety Management	2
CVE 513	Construction Quality Assurance	2
CVE 514	Engineering Professional Practice and Ethics	2
CVE 515	Final-Year Design Project and Defence	4
CVE 516	Technical Elective II	2
	Semester total	**21**

Units by year

Year	Level	Units
Year 1	100	34
Year 2	200	43
Year 3	300	41
Year 4	400	40
Year 5	500	40
Total		198

5. Option Emphasis

The option differentiates the programme in Years 3 to 5. The option-specific content is: Railway Engineering I and II; Tunnel Engineering Fundamentals; Tunnel Construction and Support Systems; Railway and Highway Systems Integration; Advanced Bridge or Tunnel Design; and Technical Electives I and II, drawn from the approved railway, tunnel and transport list. The highway, pavement and transport courses form the transport infrastructure core that all students take.

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.
Surveying fieldwork	Assess measurement, setting out, mapping and field safety.
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 contain evidence for each area below. The department must document actual facilities, available staff, maintenance arrangements and funding, not only proposed equipment.

- **Human resources:** qualified civil engineering lecturers and technical staff, including specialists in railways, tunnels and transport.
- **Surveying:** levels, total stations, GNSS equipment, levelling staves and accessories.
- **Materials laboratory:** aggregate grading, concrete testing, soil classification, compaction, asphalt testing and strength evaluation.
- **Geotechnical laboratory:** shear strength, permeability, consolidation and foundation investigation equipment; rock testing where available.
- **Hydraulics laboratory:** flow measurement, pipe flow and open-channel demonstrations.
- **Structural laboratory:** materials testing frames, strain measurement and structural mechanics apparatus.
- **Transport infrastructure:** pavement evaluation tools, highway design software, railway track models and field training arrangements.
- **Digital facilities:** CAD, GIS, surveying data processing and structural and geotechnical analysis software.
- **Library:** current textbooks, codes, standards, technical journals and digital reference access.
- **Industry partnerships:** railway organisations, road contractors, tunnelling contractors, consultancies and infrastructure agencies.

9. Quality Assurance and CCMAS Alignment

Before submission for approval, the department will complete the following:

- Map each course in Section 4 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.
- Prepare evidence for staffing, facilities, laboratories, library resources and industrial training.
- Submit the programme through the university's governance and regulatory approval processes.

10. Companion Documents

This curriculum is accompanied by the **Students' Handbook**, which gives full course specifications, and the **Lecturers' Handbook**, which gives teaching schemes, lab instructions, rubrics and assessment design. Both are subject to the same review and approval.