Curriculum

Chemical Engineering (Petroleum Refining and Petrochemical 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 Chemical Engineering (Petroleum Refining and Petrochemical option), offered by the Department of Chemical 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 chemical engineers who design, operate and improve process plants.
- Offer the Petroleum Refining and Petrochemical option, which applies process engineering to crude oil, refined products and petrochemicals.
- Build strong foundations in chemistry, thermodynamics, transport phenomena and reaction engineering.
- 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
Chemistry foundations	Apply general, organic, physical and analytical chemistry to process problems.
Process calculations and thermodynamics	Perform mass and energy balances and apply thermodynamic models.
Transport phenomena	Analyse fluid flow, heat and mass transfer in process equipment.
Reaction engineering	Design and analyse chemical and catalytic reactors.
Separation and unit operations	Design separation and solids processing operations.
Equipment and plant design	Design process equipment and integrate units into plants.
Process control and optimisation	Model, control and optimise process plant.
Refining and petroleum processing	Analyse crude oil, refining and gas processing operations.
Petrochemicals and polymers	Analyse petrochemical routes and polymer processes.
Professional practice	Demonstrate process safety, environmental responsibility, ethics and teamwork.

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. 'PR' marks Petroleum Refining courses and 'PT' marks Petrochemical courses. Both are within the Petroleum Refining and Petrochemical option.

Year 1: Engineering Foundations

Semester 1 (First semester)

Code	Course	Units	Track
CHE 101	Mathematics I	3	Core
CHE 102	General Physics I	3	Core
CHE 103	General Chemistry I	3	Core
CHE 104	Introductory Engineering	2	Core
CHE 105	Introduction to Computing	2	Core

Code	Course	Units	Track
CHE 106	Communication in English	2	Core
CHE 107	Engineering Laboratory Practicals	1	Core
CHE 108	Introduction to Chemical Engineering	2	Core
	Semester total	**18**	

Semester 2 (Second semester)

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

Year 2: Core Engineering

Semester 3 (First semester)

Code	Course	Units	Track
CHE 201	Organic Chemistry I	3	Core
CHE 202	Physical Chemistry I	3	Core
CHE 203	Engineering Mathematics	3	Core
CHE 204	Engineering Mechanics: Statics	2	Core
CHE 205	Material and Energy Balances	3	Core
CHE 206	Fluid Mechanics I	3	Core
CHE 207	Analytical Chemistry	2	Core
CHE 208	Engineering Materials	2	Core
	Semester total	**21**	

Semester 4 (Second semester)

Code	Course	Units	Track
CHE 209	Organic Chemistry II	3	Core
CHE 210	Physical Chemistry II	3	Core
CHE 211	Numerical Methods for Engineers	3	Core
CHE 212	Thermodynamics I	3	Core
CHE 213	Heat Transfer	3	Core
CHE 214	Fluid Mechanics II	3	Core
CHE 215	Chemical Engineering Laboratory I	2	Core
CHE 216	Process Instrumentation Fundamentals	2	Core
	Semester total	**22**	

Year 3: Specialist Foundations

Semester 5 (First semester)

Code	Course	Units	Track
CHE 301	Mass Transfer I	3	Core
CHE 302	Chemical Reaction Engineering I	3	Core
CHE 303	Thermodynamics II	3	Core
CHE 304	Process Dynamics and Control	3	Core
CHE 305	Unit Operations I (Separation)	3	Core
CHE 306	Process Equipment Design I	3	Core
CHE 307	Chemical Engineering Laboratory II	2	Core
CHE 308	Engineering Statistics and Research Methods	2	Core
	Semester total	**22**	

Semester 6 (Second semester)

Code	Course	Units	Track
CHE 309	Mass Transfer II	3	Core
CHE 310	Chemical Reaction Engineering II	3	Core
CHE 311	Unit Operations II	3	Core
CHE 312	Process Equipment Design II	3	Core
CHE 313	Petroleum Chemistry and Hydrocarbon Fundamentals	3	PR
CHE 314	Petroleum Refining Processes I	3	PR
CHE 315	Petrochemical Processes I	3	PT
CHE 316	Process Safety and Hazard Analysis	2	Core
	Semester total	**23**	

Year 4: Advanced Design and Industrial Practice

Semester 7 (First semester)

Code	Course	Units	Track
CHE 401	Petroleum Refining Processes II	3	PR
CHE 402	Catalysis and Catalytic Processes	3	Core
CHE 403	Petrochemical Processes II	3	PT
CHE 404	Polymer Science and Engineering	3	PT
CHE 405	Process Simulation and Design	3	Core
CHE 406	Plant Design and Economics	3	Core
CHE 407	Environmental Engineering	2	Core
CHE 408	Research Project I	2	Core
	Semester total	**22**	

Semester 8 (Second semester)

Code	Course	Units	Track
CHE 409	Petroleum Product Quality and Blending	3	PR
CHE 410	Petrochemical Process Analysis	3	PT
CHE 411	Gas Processing and Treatment	3	PR
CHE 412	Process Safety Engineering	3	Core
CHE 413	Industrial Process Control	3	Core

Code	Course	Units	Track
CHE 414	Corrosion and Materials in Process Plants	2	Core
CHE 415	Process Economics and Management	2	Core
CHE 416	Industrial Training (SIWES)	3	Core
	Semester total	**22**	

Year 5: Specialisation, Integration and Professional Readiness

Semester 9 (First semester)

Code	Course	Units	Track
CHE 501	Advanced Refinery Operations	3	PR
CHE 502	Advanced Petrochemical Technology	3	PT
CHE 503	Energy Policy and Regulation	2	Core
CHE 504	Process Optimisation	3	Core
CHE 505	Advanced Separation Processes	3	Core
CHE 506	Research Project II	3	Core
CHE 507	Bioprocess Engineering	2	Core
CHE 508	Technical Elective I	2	Core
	Semester total	**21**	

Semester 10 (Second semester)

Code	Course	Units	Track
CHE 509	Integrated Process Plant Design	3	Core
CHE 510	Refinery Plant Design	2	PR
CHE 511	Petrochemical Plant Design	2	PT
CHE 512	Environmental Impact and Sustainability	2	Core
CHE 513	Engineering Professional Practice and Ethics	2	Core
CHE 514	Risk Management in Process Industries	2	Core
CHE 515	Final-Year Design Project and Defence	4	Core
CHE 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	45
Year 4	400	44
Year 5	500	40
Total		207

5. Option Emphasis

Students choose the Petroleum Refining and Petrochemical option in Year 3, Semester 6. The Petroleum Refining (PR) courses cover petroleum chemistry, crude distillation, catalytic cracking and reforming, hydrotreating, product quality and blending, gas processing, advanced refinery operations and refinery plant

design. The Petrochemical (PT) courses cover feedstocks and steam cracking, downstream petrochemical routes, polymer science, petrochemical process analysis, advanced petrochemical technology and petrochemical plant design. Core courses in process fundamentals, reaction engineering, separations, control, safety and plant design 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.

- **Process laboratory:** distillation, absorption, heat exchanger and reactor test rigs.
- **Analytical laboratory:** chromatography and titration facilities for product and process analysis.
- **Petroleum product testing:** facilities for density, flash point, viscosity and distillation tests.
- **Process simulation software:** licensed steady-state and dynamic simulators.
- **Industry links:** refineries, petrochemical plants and gas processors for SIWES and site visits.
- **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.