Lecturers' Handbook

Petroleum Engineering (Offshore, Subsea and Pipeline option)

Faculty of Engineering, Akpakip Oro University (AOU)

For teaching staff and laboratory supervisors

Draft for departmental approval

1. Purpose and Responsibilities

This handbook supports teaching staff delivering the Petroleum Engineering (Offshore, Subsea and Pipeline option) programme. It sets out the outcome mapping, teaching schemes, lesson-planning expectations, laboratory procedures, assessment design and marking standards. It is a working guide and does not replace the university's regulations.

- Deliver courses against the learning outcomes in the Students' Handbook.
- Publish the week-by-week scheme and assessment plan to students in the first week.
- Design assessments that test the stated outcomes at the appropriate level.
- Mark consistently, moderate with colleagues and give timely, specific feedback.
- Supervise projects, SIWES placements and laboratory work to the standards set here.

2. Programme Outcome Mapping

Each graduate competency is developed across several courses. The mapping below is generated from the course list and must be checked against the CCMAS mapping before accreditation.

Competency	Main contributing courses
Geoscience	PET 201, PET 207, PET 209, PET 215, PET 301
Reservoir rock and fluids	PET 302, PET 305, PET 304, PET 312
Reservoir engineering	PET 310, PET 401, PET 412, PET 413, PET 504
Drilling and completions	PET 303, PET 309, PET 403, PET 409
Production and flow assurance	PET 311, PET 402, PET 503, PET 407
Mechanics and thermo-fluids	PET 203, PET 204, PET 211, PET 205, PET 212, PET 206, PET 213, PET 214
Subsea and pipeline engineering	PET 404, PET 410, PET 313, PET 405, PET 411, PET 502
Offshore structures and risers	PET 314, PET 406, PET 414, PET 501, PET 306
Field development and economics	PET 509, PET 415, PET 512, PET 316, PET 510
Safety, environment and professional practice	PET 506, PET 511, PET 513, PET 505, PET 514, PET 416, PET 104

3. Teaching Schemes

For each semester, the table shows the delivery mode and assessment method. Contact hours and rooms are set by the timetable.

Year 1: Engineering Foundations

Semester 1

Code	Course	Units	Delivery	Assessment
PET 101	Mathematics I	3	Lecture	CA 30 / Exam 70
PET 102	General Physics I	3	Lecture	CA 30 / Exam 70
PET 103	General Chemistry I	2	Lecture	CA 30 / Exam 70
PET 104	Introductory Engineering	2	Lecture	CA 50 / Exam 50
PET 105	Introduction to Computing	2	Lecture	CA 60 / Exam 40
PET 106	Communication in English	2	Lecture	CA 60 / Exam 40
PET 107	Engineering Laboratory Practicals	1	Lecture with lab / practical	Lab reports 100
PET 108	Introduction to Petroleum Engineering	2	Lecture	CA 40 / Exam 60

Semester 2

Code	Course	Units	Delivery	Assessment
PET 109	Mathematics II	3	Lecture	CA 30 / Exam 70
PET 110	General Physics II	3	Lecture	CA 30 / Exam 70
PET 111	General Chemistry II	2	Lecture	CA 30 / Exam 70
PET 112	Engineering Drawing and Graphics	2	Lecture with lab / practical	Coursework 60 / Exam 40
PET 113	Programming and Engineering Computation	2	Lecture	CA 50 / Exam 50
PET 114	Nigerian Peoples and Cultures	2	Lecture	CA 40 / Exam 60
PET 115	Earth Materials Laboratory	1	Lecture with lab / practical	Lab reports 100
PET 116	Engineering Workshop and Safety	2	Lecture with lab / practical	Practical 70 / Exam 30

Year 2: Core Engineering

Semester 3

Code	Course	Units	Delivery	Assessment
PET 201	Physical Geology	3	Lecture	CA 30 / Exam 70
PET 202	Engineering Mathematics	3	Lecture	CA 30 / Exam 70
PET 203	Engineering Mechanics: Statics	3	Lecture	CA 30 / Exam 70
PET 204	Strength of Materials I	3	Lecture	CA 30 / Exam 70
PET 205	Thermodynamics I	3	Lecture	CA 30 / Exam 70
PET 206	Fluid Mechanics I	3	Lecture	CA 30 / Exam 70
PET 207	Mineralogy and Petrology	2	Lecture	CA 40 / Exam 60
PET 208	Petroleum Chemistry Fundamentals	2	Lecture	CA 40 / Exam 60

Semester 4

Code	Course	Units	Delivery	Assessment
PET 209	Stratigraphy and Sedimentology	3	Lecture	CA 30 / Exam 70
PET 210	Numerical Methods for Engineers	3	Lecture	CA 40 / Exam 60
PET 211	Strength of Materials II	3	Lecture	CA 30 / Exam 70
PET 212	Thermodynamics II	3	Lecture	CA 30 / Exam 70
PET 213	Fluid Mechanics II	3	Lecture	CA 30 / Exam 70
PET 214	Heat Transfer	2	Lecture	CA 40 / Exam 60
PET 215	Geophysics Fundamentals	2	Lecture	CA 40 / Exam 60
PET 216	Earth Sciences Laboratory I	1	Lecture with lab / practical	Lab reports 100

Year 3: Specialist Foundations

Semester 5

Code	Course	Units	Delivery	Assessment
PET 301	Petroleum Geology	3	Lecture	CA 30 / Exam 70
PET 302	Reservoir Rock Properties	3	Lecture	CA 30 / Exam 70
PET 303	Drilling Engineering I	3	Lecture	CA 30 / Exam 70

Code	Course	Units	Delivery	Assessment
PET 304	Well Logging and Formation Evaluation	3	Lecture	CA 30 / Exam 70
PET 305	Reservoir Fluid Properties	3	Lecture	CA 30 / Exam 70
PET 306	Soil Mechanics I	3	Lecture	CA 30 / Exam 70
PET 307	Engineering Statistics and Research Methods	2	Lecture	CA 40 / Exam 60
PET 308	Petroleum Laboratory I	2	Lecture with lab / practical	Lab reports 100

Semester 6

Code	Course	Units	Delivery	Assessment
PET 309	Drilling Engineering II	3	Lecture	CA 30 / Exam 70
PET 310	Reservoir Engineering I	3	Lecture	CA 30 / Exam 70
PET 311	Petroleum Production Engineering I	3	Lecture	CA 30 / Exam 70
PET 312	Fluid Flow in Porous Media	3	Lecture	CA 30 / Exam 70
PET 313	Pipeline Engineering Fundamentals	3	Lecture	CA 30 / Exam 70
PET 314	Offshore Engineering Fundamentals	3	Lecture	CA 30 / Exam 70
PET 315	Petroleum Laboratory II	2	Lecture with lab / practical	Lab reports 100
PET 316	Engineering Economics	2	Lecture	CA 40 / Exam 60

Year 4: Advanced Design and Industrial Practice

Semester 7

Code	Course	Units	Delivery	Assessment
PET 401	Reservoir Engineering II	3	Lecture	CA 30 / Exam 70
PET 402	Petroleum Production Engineering II	3	Lecture	CA 30 / Exam 70
PET 403	Well Completion and Stimulation	3	Lecture	CA 30 / Exam 70
PET 404	Subsea Systems Engineering	3	Lecture	CA 30 / Exam 70
PET 405	Pipeline Design and Installation	3	Lecture	CA 30 / Exam 70
PET 406	Offshore Structures	3	Lecture	CA 30 / Exam 70
PET 407	Flow Assurance	3	Lecture	CA 30 / Exam 70
PET 408	Research Project I	2	Studio / project supervision	Proposal 100

Semester 8

Code	Course	Units	Delivery	Assessment
PET 409	Offshore Drilling Operations	3	Lecture	CA 30 / Exam 70
PET 410	Subsea Production Systems	3	Lecture	CA 30 / Exam 70
PET 411	Pipeline Integrity and Corrosion Management	3	Lecture	CA 30 / Exam 70
PET 412	Reservoir Simulation	3	Lecture	Coursework 60 / Exam 40
PET 413	Enhanced Oil Recovery	3	Lecture	CA 30 / Exam 70
PET 414	Marine Risers and Mooring Systems	3	Lecture	CA 30 / Exam 70
PET 415	Petroleum Economics and Project Management	2	Studio / project supervision	CA 40 / Exam 60

Code	Course	Units	Delivery	Assessment
PET 416	Industrial Training (SIWES)	3	Industrial placement	Logbook 40 / Report 40 / Assessor 20

Year 5: Specialisation, Integration and Professional Readiness

Semester 9

Code	Course	Units	Delivery	Assessment
PET 501	Advanced Offshore Engineering	3	Lecture	CA 30 / Exam 70
PET 502	Advanced Subsea Engineering	3	Lecture	CA 30 / Exam 70
PET 503	Multiphase Flow in Pipelines	3	Lecture	CA 30 / Exam 70
PET 504	Petroleum Reservoir Management	3	Lecture	CA 30 / Exam 70
PET 505	Oil and Gas Policy and Regulation	2	Lecture	CA 40 / Exam 60
PET 506	Health Safety and Environment in Petroleum Operations	2	Lecture	CA 40 / Exam 60
PET 507	Research Project II	3	Studio / project supervision	Project 100
PET 508	Technical Elective I	2	Lecture	CA 40 / Exam 60

Semester 10

Code	Course	Units	Delivery	Assessment
PET 509	Integrated Offshore Field Development	3	Lecture	Design project 100
PET 510	Decommissioning and Abandonment	2	Lecture	CA 40 / Exam 60
PET 511	Risk-Based Inspection and Asset Integrity	2	Lecture	CA 40 / Exam 60
PET 512	Field Development Economics	2	Lecture	CA 40 / Exam 60
PET 513	Environmental Impact and Sustainability	2	Lecture	CA 40 / Exam 60
PET 514	Engineering Professional Practice and Ethics	2	Lecture	CA 50 / Exam 50
PET 515	Final-Year Design Project and Defence	4	Studio / project supervision	Project 60 / Defence 40
PET 516	Technical Elective II	2	Lecture	CA 40 / Exam 60

4. Lesson Planning

Every lecture and practical session should have a written lesson plan, kept with the course file and sampled during moderation.

Lesson plan template

- **Course and week:** code, title, week number.
- **Learning outcome(s):** the outcome(s) this session addresses.
- **Prerequisites, resources and activities:** what students must know, what is needed, and the timed outline.
- **Check for understanding:** at least one formative question or task.
- **Homework or preparation:** the task and its due date.

Worked example: Darcy's law and linear flow (2-hour session)

Time	Activity	Check for understanding
0 to 10 min	Starter: recall of permeability, viscosity and pressure gradient	Quick oral questions

Time	Activity	Check for understanding
10 to 40 min	Explanation: Darcy's law, units and the linear flow equation	Students convert permeability units correctly
40 to 65 min	Worked example: flow rate through a core sample	Pairs solve a similar case
65 to 95 min	Group problem: estimate the pressure drop along a sandstone layer	Each group presents its result
95 to 110 min	Short quiz on the session content	Marks recorded for formative tracking
110 to 120 min	Summary; homework on radial flow towards a well	Homework due next session

5. Laboratory and Practical Instructions

Standard references are given for orientation. Confirm the current edition and the department's approved procedure before issuing instructions to students.

5.1 Porosity and permeability of core samples (Petroleum Laboratory I)

Aim. Measure the porosity and gas permeability of reservoir core plugs.

Equipment.

- Core plugs
- Helium porosimeter
- Permeameter
- Callipers and balance

Procedure.

1. Measure the dimensions and dry weight of each core plug.
2. Measure grain volume and calculate porosity with the porosimeter.
3. Measure gas permeability at three confining pressures.
4. Tabulate the results and comment on the relationship between porosity and permeability.

Safety.

- Handle gas cylinders with the regulators and restraints the lab requires.
- Wear eye protection when handling core plugs.

Report requirements. Include the core data, porosity and permeability values, the Klinkenberg correction where applied, and a discussion of the results.

5.2 Drilling mud density, rheology and filtration (Drilling Engineering I)

Aim. Measure the key properties of a water-based drilling mud and check them against the design specification.

Equipment.

- Mud balance
- Rotational viscometer
- Filter press
- Stopwatch and graduated cylinder

Procedure.

1. Measure the mud density with the mud balance.
2. Measure the viscometer readings at the standard speeds and calculate the plastic viscosity and yield point.
3. Measure the filtrate volume under standard pressure and time.
4. Compare the results with the specification and recommend any adjustment.

Safety.

- Mud additives may be irritant: wear gloves and eye protection.
- Keep the filter press cell closed under pressure only as directed.

Report requirements. Include the readings, calculated rheological properties, filtrate volume and a comparison with the design specification.

5.3 Two-phase flow regimes in a pipeline loop (Pipeline Engineering Fundamentals)

Aim. Observe the flow regimes of air and water in a horizontal pipe and compare the pressure drop with predictions.

Equipment.

- Transparent test section
- Air and water supply
- Flow meters and pressure taps
- High-speed camera where available

Procedure.

1. Set the water and air flow rates for the first test point.
2. Observe and record the flow regime.
3. Measure the pressure drop along the test section.
4. Repeat over a range of flow rates and compare the pressure drop with the design correlation.

Safety.

- Check pipework pressure ratings before running the loop.
- Never open the test section while it is pressurised.

Report requirements. Include the regime observations, the pressure drop data, a flow regime map and a comparison with the correlation used.

5.4 Well log interpretation (Well Logging and Formation Evaluation)

Aim. Interpret a set of wireline logs to identify a reservoir zone and estimate its porosity and water saturation.

Equipment.

- Digital well log data set
- Log analysis software
- Formation data sheet

Procedure.

1. Load the logs and check their depth registration and units.
2. Identify the reservoir and non-reservoir zones from gamma ray and resistivity.
3. Calculate porosity from the density and neutron logs.
4. Estimate water saturation using Archie's equation and report the reservoir net pay.

Safety.

- Not applicable beyond normal computer-use rules; check data licence terms before use.

Report requirements. Include the interpreted zones, the calculated porosity and saturation, the net pay estimate and the assumptions made.

6. Assessment Design

6.1 Assessment blueprint for written examinations

Cognitive level	Typical weight	Typical question form
Remember	10%	Definitions, standard values, short recall
Understand	20%	Explain principles, interpret results
Apply	40%	Calculations, applying standards and methods
Analyse	20%	Multi-step problems and system analysis
Evaluate	10%	Design choices, critique, justification

6.2 Continuous assessment

- Each course should have at least two CA components, spread across the semester.
- At least one CA item should test an outcome the exam does not.
- Publish all CA marking schemes before the task is issued.

7. Rubrics

Each criterion is scored from 1 to 4. The total is converted to the mark scale in the regulations.

7.1 Design project rubric

Criterion	4 Excellent	3 Good	2 Satisfactory	1 Unsatisfactory
Design concept	Clear, justified and suited to the brief	Sound with minor gaps	Partly justified	Unclear or unsuitable
Calculations or analysis	Complete, correct and checked	Minor errors, method correct	Method partly correct	Major errors or missing
Use of standards	Correct standards applied and cited	Mostly applied correctly	Some misapplied	Not used
Drawings, code or specifications	Clear, complete, to convention	Minor omissions	Incomplete	Not usable
Safety and sustainability	Addressed in depth	Addressed adequately	Mentioned only	Not addressed

7.2 Laboratory report rubric

Criterion	4 Excellent	3 Good	2 Satisfactory	1 Unsatisfactory
Method	Complete and reproducible	Mostly complete	Partly complete	Not usable
Data and analysis	Accurate and correctly processed	Minor errors	Several errors	Major errors
Discussion	Insightful, error sources analysed	Adequate	Superficial	Absent
Presentation	Clear and professional	Mostly clear	Hard to follow	Poor

7.3 Oral defence rubric

Criterion	4 Excellent	3 Good	2 Satisfactory	1 Unsatisfactory
Explanation	Clear and complete	Clear with minor gaps	Partial	Unclear
Response to questions	Confident, accurate, reasoned	Mostly accurate	Some accurate	Mostly inaccurate
Professional judgement	Justifies trade-offs well	Justifies most decisions	Limited	None

8. Marking, Moderation and Feedback

- Mark against the published scheme, and record the reason for any deduction.
- Moderate a sample of at least 10% of scripts or reports across the mark range, with a second marker.
- Return feedback within the period set by the regulations, identifying strengths and next steps.
- Record any change to a published mark, with the reason and the approver.

9. Supervision of Projects and SIWES

- Supervisors meet each student at least every two weeks and keep a meeting log.
- Projects require an approved written proposal before execution.
- Check each SIWES placement before the student starts; review the logbook and report, and complete the assessor's form.

10. Quality Assurance and Accreditation Readiness

- Keep a course file for each course: specification, scheme, assessment items, marking schemes, moderation records and feedback.
- Maintain records of equipment, calibration and maintenance for each laboratory.
- Invite an external examiner to review standards and assessment, and act on their report.
- Update the CCMAS mapping whenever a course changes.

11. Academic Integrity and Professional Ethics

- Explain the university's academic integrity policy at the start of every course.
- Report suspected misconduct through the department to the appropriate committee.
- Model professional ethics, including honest reporting of data and clear acknowledgement of sources.