Lecturers' Handbook

Agricultural and Bioresources Engineering (Food, Seafood and Packaging; Environmental and Waste-to-Energy options)

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 Agricultural and Bioresources Engineering (Food, Seafood and Packaging; Environmental and Waste-to-Energy options) 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
Agricultural engineering science	ABE 201, ABE 209, ABE 202, ABE 203, ABE 211, ABE 210, ABE 204, ABE 212
Soil and water	ABE 205, ABE 214, ABE 306, ABE 505, ABE 208
Farm power and machinery	ABE 215, ABE 301, ABE 316
Bioresources and biology	ABE 115, ABE 206, ABE 207, ABE 302
Food science and processing	ABE 303, ABE 304, ABE 309, ABE 401, ABE 402, ABE 501
Post-harvest and cold chain	ABE 310, ABE 410, ABE 213, ABE 305
Seafood	ABE 311, ABE 403, ABE 411
Packaging	ABE 312, ABE 404, ABE 502
Waste and bioenergy	ABE 313, ABE 314, ABE 405, ABE 406, ABE 412, ABE 413, ABE 414, ABE 503, ABE 511
Environment, sustainability and professional practice	ABE 407, ABE 504, ABE 415, ABE 513, ABE 512, ABE 416, ABE 514

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

Code	Course	Units	Delivery	Assessment
ABE 108	Introduction to Agricultural and Bioresources Engineering	2	Lecture	CA 40 / Exam 60

Semester 2

Code	Course	Units	Delivery	Assessment
ABE 109	Mathematics II	3	Lecture	CA 30 / Exam 70
ABE 110	General Physics II	3	Lecture	CA 30 / Exam 70
ABE 111	General Chemistry II	2	Lecture	CA 30 / Exam 70
ABE 112	Engineering Drawing and Graphics	2	Lecture with lab / practical	Coursework 60 / Exam 40
ABE 113	Programming and Engineering Computation	2	Lecture	CA 50 / Exam 50
ABE 114	Nigerian Peoples and Cultures	2	Lecture	CA 40 / Exam 60
ABE 115	Biology for Bioresources	3	Lecture	CA 30 / Exam 70
ABE 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
ABE 201	Engineering Mechanics: Statics	3	Lecture	CA 30 / Exam 70
ABE 202	Strength of Materials I	3	Lecture	CA 30 / Exam 70
ABE 203	Engineering Mathematics	3	Lecture	CA 30 / Exam 70
ABE 204	Fluid Mechanics I	3	Lecture	CA 30 / Exam 70
ABE 205	Agricultural Soil Science	3	Lecture	CA 30 / Exam 70
ABE 206	Microbiology for Engineers	3	Lecture	CA 40 / Exam 60
ABE 207	Biochemistry Fundamentals	2	Lecture	CA 40 / Exam 60
ABE 208	Agricultural Surveying	2	Lecture with lab / practical	Practical 60 / Exam 40

Semester 4

Code	Course	Units	Delivery	Assessment
ABE 209	Engineering Mechanics: Dynamics	3	Lecture	CA 30 / Exam 70
ABE 210	Thermodynamics I	3	Lecture	CA 30 / Exam 70
ABE 211	Numerical Methods for Engineers	3	Lecture	CA 40 / Exam 60
ABE 212	Fluid Mechanics II	3	Lecture	CA 30 / Exam 70
ABE 213	Heat Transfer	3	Lecture	CA 30 / Exam 70
ABE 214	Soil and Water Engineering	3	Lecture	CA 30 / Exam 70
ABE 215	Agricultural Machinery I	3	Lecture	CA 30 / Exam 70
ABE 216	Agricultural and Bioresources Laboratory I	2	Lecture with lab / practical	Lab reports 100

Year 3: Specialist Foundations

Semester 5

Code	Course	Units	Delivery	Assessment
ABE 301	Agricultural Machinery II	3	Lecture	CA 30 / Exam 70
ABE 302	Biomass Properties and Characterisation	3	Lecture	CA 30 / Exam 70
ABE 303	Food Chemistry	3	Lecture	CA 30 / Exam 70
ABE 304	Food Microbiology	3	Lecture	CA 40 / Exam 60
ABE 305	Unit Operations for Bioprocessing	3	Lecture	CA 30 / Exam 70
ABE 306	Irrigation and Drainage Engineering	3	Lecture	CA 30 / Exam 70
ABE 307	Engineering Statistics and Research Methods	2	Lecture	CA 40 / Exam 60
ABE 308	Agricultural and Bioresources Laboratory II	2	Lecture with lab / practical	Lab reports 100

Semester 6

Code	Course	Units	Delivery	Assessment
ABE 309	Food Process Engineering	3	Lecture	CA 30 / Exam 70
ABE 310	Post-Harvest Engineering	3	Lecture	CA 30 / Exam 70
ABE 311	Fish and Seafood Processing Technology	3	Lecture	CA 30 / Exam 70
ABE 312	Packaging Materials and Design	3	Lecture	CA 30 / Exam 70
ABE 313	Waste Management Fundamentals	3	Lecture	CA 30 / Exam 70
ABE 314	Anaerobic Digestion Fundamentals	3	Lecture	CA 30 / Exam 70
ABE 315	Engineering Economics	2	Lecture	CA 40 / Exam 60
ABE 316	Agricultural Structures and Buildings	2	Lecture	CA 40 / Exam 60

Year 4: Advanced Design and Industrial Practice

Semester 7

Code	Course	Units	Delivery	Assessment
ABE 401	Food Engineering Operations	3	Lecture	CA 30 / Exam 70
ABE 402	Food Preservation and Safety	3	Lecture	CA 30 / Exam 70
ABE 403	Seafood Quality and Safety	2	Lecture	CA 40 / Exam 60
ABE 404	Packaging Design and Testing	3	Lecture	CA 30 / Exam 70
ABE 405	Biogas Technology	3	Lecture	CA 30 / Exam 70
ABE 406	Waste-to-Energy Conversion	3	Lecture	CA 30 / Exam 70
ABE 407	Environmental Engineering	2	Lecture	CA 40 / Exam 60
ABE 408	Research Project I	2	Studio / project supervision	Proposal 100

Semester 8

Code	Course	Units	Delivery	Assessment
ABE 409	Food Product Development	3	Lecture	CA 30 / Exam 70
ABE 410	Cold Chain and Refrigeration Engineering	3	Lecture	CA 30 / Exam 70
ABE 411	Fish Processing Plant Design	3	Lecture	CA 30 / Exam 70
ABE 412	Bioreactor Design and Operation	3	Lecture	CA 30 / Exam 70

Code	Course	Units	Delivery	Assessment
ABE 413	Composting and Organic Waste Management	2	Lecture	CA 40 / Exam 60
ABE 414	Solid Waste Engineering	3	Lecture	CA 30 / Exam 70
ABE 415	Climate and Renewable Energy for Agriculture	2	Lecture	CA 40 / Exam 60
ABE 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
ABE 501	Advanced Food Process Engineering	3	Lecture	CA 30 / Exam 70
ABE 502	Packaging Systems and Sustainability	2	Lecture	CA 40 / Exam 60
ABE 503	Advanced Waste-to-Energy Systems	3	Lecture	CA 30 / Exam 70
ABE 504	Environmental Impact Assessment	2	Lecture	CA 40 / Exam 60
ABE 505	Water Quality and Treatment	3	Lecture	CA 30 / Exam 70
ABE 506	Research Project II	3	Studio / project supervision	Project 100
ABE 507	Agricultural Systems Management	2	Lecture	CA 40 / Exam 60
ABE 508	Technical Elective I	2	Lecture	CA 40 / Exam 60

Semester 10

Code	Course	Units	Delivery	Assessment
ABE 509	Integrated Bioresources System Design	3	Lecture	Design project 100
ABE 510	Food Plant Design and Layout	2	Lecture	CA 40 / Exam 60
ABE 511	Landfill and Waste Facility Design	2	Lecture	CA 40 / Exam 60
ABE 512	Engineering Professional Practice and Ethics	2	Lecture	CA 50 / Exam 50
ABE 513	Sustainable Agriculture and Food Systems	2	Lecture	CA 40 / Exam 60
ABE 514	Risk and Safety in Agro-processing	2	Lecture	CA 40 / Exam 60
ABE 515	Final-Year Design Project and Defence	4	Studio / project supervision	Project 60 / Defence 40
ABE 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: Heat load estimation for a cold store (2-hour session)

Time	Activity	Check for understanding
0 to 10 min	Starter: recall of conduction through a wall and the U-value	Quick oral questions
10 to 40 min	Explanation: heat sources in a cold store (fabric, product, infiltration, equipment)	Students list three heat sources
40 to 65 min	Worked example: estimate the fabric load for a stated store	Pairs solve a similar case
65 to 95 min	Group problem: estimate the product load and the required refrigeration capacity	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 the effect of door opening on infiltration load	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 Field infiltration with a double-ring infiltrometer (Soil and Water Engineering)

Aim. Measure the infiltration rate of a soil and fit an infiltration model to the data.

Equipment.

- Double-ring infiltrometer
- Water supply and measuring vessel
- Timer and ruler
- Soil sampling tools

Procedure.

1. Select and level the test site and install the rings.
2. Fill the rings with water to a fixed depth and start the timer.
3. Record the water level drop at regular intervals until the rate stabilises.
4. Fit the infiltration data to a model and report the steady infiltration rate.

Safety.

- Watch for slippery and uneven ground around the rings.
- Use gloves when handling wet soil and water-borne contaminants.

Report requirements. Include the infiltration data, the fitted model, the steady rate and the soil description.

5.2 Power take-off and tractor performance test (Agricultural Machinery I)

Aim. Measure the power output and fuel consumption of a tractor at the power take-off under load.

Equipment.

- Tractor with power take-off
- Dynamometer or brake
- Fuel measurement system
- Tachometer

Procedure.

1. Set up the tractor on the test rig and check all guards are in place.
2. Run the tractor at the rated speed with the dynamometer at zero load.
3. Increase the load in steps, recording torque, speed and fuel flow at each step.

4. Calculate the power and specific fuel consumption and plot the results.

Safety.

- Keep guards on the PTO shaft at all times; no one stands in line with the shaft.
- Test only in a ventilated area with an extinguisher to hand.

Report requirements. Include the test data, power and fuel consumption curves, and a comparison with the manufacturer's rating.

5.3 Aerobic plate count of a food sample (Food Microbiology)

Aim. Estimate the aerobic bacterial load of a food sample by the standard plate count method.

Equipment.

- Food sample
- Diluent and sterile pipettes
- Nutrient agar plates
- Incubator and colony counter

Procedure.

1. Prepare a homogenised suspension of the sample in diluent.
2. Make a series of tenfold dilutions.
3. Spread or pour the selected dilutions onto plates and incubate at the specified temperature.
4. Count the colonies on plates with 30 to 300 colonies and calculate the count per gram.

Safety.

- Work in a biosafety cabinet and disinfect the bench before and after work.
- Autoclave all used plates and tips before disposal.

Report requirements. Include the dilution scheme, colony counts, the calculated count per gram and the control results.

5.4 Biochemical methane potential test (Biogas Technology)

Aim. Determine the methane yield of a substrate in a batch anaerobic digestion test.

Equipment.

- Batch digester bottles
- Inoculum from an active digester
- Substrate sample
- Gas measurement and gas analyser

Procedure.

1. Prepare the substrate and inoculum at the specified ratio, and purge the bottles with nitrogen.
2. Seal the bottles and place them in a water bath at the set temperature.
3. Record the biogas volume and methane content at regular intervals until gas production stops.
4. Calculate the methane yield per gram of volatile solids and compare it with the blank.

Safety.

- Biogas is flammable: keep ignition sources away and vent gas safely.
- Check bottles for leaks before placing them in the bath.

Report requirements. Include the methane yields, the blank correction, the gas production curves and the uncertainty analysis.

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

Criterion	4 Excellent	3 Good	2 Satisfactory	1 Unsatisfactory
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.