Lecturers' Handbook

Civil Engineering: Railway, Tunnel and Transport Infrastructure 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 Railway, Tunnel and Transport Infrastructure option. It sets out the teaching schemes, lesson-planning expectations, laboratory procedures, assessment design and marking standards. It is a working guide and does not replace the university's academic 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 shows the main contributing courses, to be checked against the CCMAS mapping in the curriculum.

Competency	Main contributing courses (codes as in the curriculum)
Engineering science	CVE 101, 102, 109, 110, 201, 202, 208, 209, 210
Structural design	CVE 215, 301, 309, 401, 402, 409
Geotechnical engineering	CVE 212, 214, 302, 306, 310, 503
Highway engineering	CVE 303, 311, 403, 405, 410, 501, 502, 505
Railway engineering	CVE 315, 404, 510
Tunnel engineering	CVE 316, 412, 511
Construction management	CVE 307, 406, 414, 509
Sustainability	CVE 407, 504
Digital engineering	CVE 105, 113, 203, 204, 211
Professional practice	CVE 104, 106, 416, 512, 514

Codes in this table are indicative. The department must confirm them against the final course list before the mapping is used for accreditation.

3. Teaching Schemes

The table for each year shows the delivery mode and assessment method for each course. Contact hours per week and room allocations are set by the timetable.

Year 1: Engineering Foundations

Semester 1

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

Semester 2

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

Year 2: Core Civil Engineering

Semester 3

Code	Course	Units	Delivery	Assessment
CVE 201	Engineering Mechanics: Statics	3	Lecture	CA 30 / Exam 70
CVE 202	Strength of Materials I	3	Lecture	CA 30 / Exam 70
CVE 203	Engineering Surveying I	3	Lecture with lab / practical	CA 40 / Exam 60
CVE 204	Civil Engineering Drawing and CAD	2	Lecture with lab / practical	Coursework 100
CVE 205	Fluid Mechanics I	3	Lecture	CA 30 / Exam 70
CVE 206	Building and Construction Technology	2	Lecture	CA 40 / Exam 60
CVE 207	Engineering Materials	2	Lecture	CA 40 / Exam 60
CVE 208	Engineering Mathematics	3	Lecture	CA 30 / Exam 70

Semester 4

Code	Course	Units	Delivery	Assessment
CVE 209	Engineering Mechanics: Dynamics	3	Lecture	CA 30 / Exam 70
CVE 210	Strength of Materials II	3	Lecture	CA 30 / Exam 70
CVE 211	Engineering Surveying II	3	Lecture with lab / practical	CA 40 / Exam 60
CVE 212	Engineering Geology	2	Lecture	CA 40 / Exam 60
CVE 213	Fluid Mechanics II	3	Lecture	CA 30 / Exam 70
CVE 214	Soil Mechanics I	3	Lecture	CA 30 / Exam 70
CVE 215	Structural Analysis I	3	Lecture	CA 30 / Exam 70
CVE 216	Introduction to Transportation Engineering	2	Lecture	CA 40 / Exam 60

Year 3: Transport and Infrastructure Engineering

Semester 5

Code	Course	Units	Delivery	Assessment
CVE 301	Structural Analysis II	3	Lecture	CA 30 / Exam 70

Code	Course	Units	Delivery	Assessment
CVE 302	Soil Mechanics II	3	Lecture	CA 30 / Exam 70
CVE 303	Highway Engineering I	3	Lecture	CA 40 / Exam 60
CVE 304	Transportation Engineering	2	Lecture	CA 40 / Exam 60
CVE 305	Engineering Surveying and Setting Out	2	Lecture with lab / practical	Practical 60 / Exam 40
CVE 306	Geotechnical Engineering	3	Lecture	CA 30 / Exam 70
CVE 307	Construction Engineering	2	Lecture	CA 40 / Exam 60
CVE 308	Engineering Statistics and Research Methods	2	Lecture	CA 40 / Exam 60

Semester 6

Code	Course	Units	Delivery	Assessment
CVE 309	Reinforced Concrete Design I	3	Lecture	CA 30 / Exam 70
CVE 310	Foundation Engineering	3	Lecture	CA 30 / Exam 70
CVE 311	Highway Engineering II	3	Lecture	CA 30 / Exam 70
CVE 312	Pavement Materials and Asphalt Technology	2	Lecture with lab / practical	Lab 60 / Exam 40
CVE 313	Engineering Hydrology	2	Lecture	CA 40 / Exam 60
CVE 314	Highway Drainage and Erosion Control	2	Lecture	CA 40 / Exam 60
CVE 315	Railway Engineering I	3	Lecture	CA 40 / Exam 60
CVE 316	Tunnel Engineering Fundamentals	3	Lecture	CA 40 / Exam 60

Year 4: Advanced Design and Industrial Practice

Semester 7

Code	Course	Units	Delivery	Assessment
CVE 401	Reinforced Concrete Design II	3	Lecture	CA 30 / Exam 70
CVE 402	Steel Structures	3	Lecture	CA 30 / Exam 70
CVE 403	Highway Geometric Design	3	Lecture	Design project 60 / Exam 40
CVE 404	Railway Engineering II	3	Lecture	CA 40 / Exam 60
CVE 405	Traffic Engineering and Road Safety	2	Lecture	CA 40 / Exam 60
CVE 406	Construction Project Management	2	Studio / project supervision	CA 40 / Exam 60
CVE 407	Environmental Engineering	2	Lecture	CA 40 / Exam 60
CVE 408	Research Project I	2	Studio / project supervision	Proposal 100

Semester 8

Code	Course	Units	Delivery	Assessment
CVE 409	Bridge Engineering	3	Lecture	CA 30 / Exam 70
CVE 410	Advanced Pavement Design	3	Lecture	CA 30 / Exam 70
CVE 411	Road Construction and Maintenance	2	Lecture	CA 40 / Exam 60
CVE 412	Tunnel Construction and Support Systems	3	Lecture	CA 30 / Exam 70
CVE 413	Transportation Infrastructure Planning	2	Lecture	CA 40 / Exam 60

Code	Course	Units	Delivery	Assessment
CVE 414	Construction Contracts and Cost Estimation	2	Lecture	CA 40 / Exam 60
CVE 415	Infrastructure Asset Management	2	Lecture	CA 40 / Exam 60
CVE 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
CVE 501	Advanced Highway Design	3	Lecture	Design project 60 / Exam 40
CVE 502	Highway Rehabilitation and Asset Management	2	Lecture	CA 40 / Exam 60
CVE 503	Advanced Geotechnical Engineering	3	Lecture	CA 30 / Exam 70
CVE 504	Sustainable and Climate-Resilient Infrastructure	2	Lecture	CA 40 / Exam 60
CVE 505	Pavement Evaluation and Quality Control	2	Lecture with lab / practical	Lab/project 60 / Exam 40
CVE 506	Transport Infrastructure Economics	2	Lecture	CA 40 / Exam 60
CVE 507	Research Project II	3	Studio / project supervision	Project 100
CVE 508	Technical Elective I	2	Lecture	CA 40 / Exam 60

Semester 10

Code	Course	Units	Delivery	Assessment
CVE 509	Integrated Transport Infrastructure Design	3	Lecture	Design project 100
CVE 510	Railway and Highway Systems Integration	3	Lecture	CA 40 / Exam 60
CVE 511	Advanced Bridge or Tunnel Design	3	Lecture	CA 30 / Exam 70
CVE 512	Infrastructure Risk and Safety Management	2	Lecture	CA 40 / Exam 60
CVE 513	Construction Quality Assurance	2	Lecture	CA 40 / Exam 60
CVE 514	Engineering Professional Practice and Ethics	2	Lecture	CA 50 / Exam 50
CVE 515	Final-Year Design Project and Defence	4	Studio / project supervision	Project 60 / Defence 40
CVE 516	Technical Elective II	2	Lecture	CA 40 / Exam 60

4. Lesson Planning

Every lecture and practical session should have a written lesson plan. Plans are 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) from the course specification that this session addresses.
- **Prerequisites:** what students must already know.
- **Resources:** slides, worked examples, codes, equipment.

- **Activities and timing:** an outline of the session with minutes allocated.
- **Check for understanding:** at least one formative question or task.
- **Homework or preparation:** the task and its due date.

Worked example: Railway Engineering I, track geometry (2-hour session)

Time	Activity	Check for understanding
0 to 10 min	Starter: recall of circular curve terms (radius, deflection, tangent length)	Quick oral questions
10 to 35 min	Explanation: horizontal curves, superelevation and cant on track	Students state the purpose of cant
35 to 60 min	Worked example: calculate cant for a given speed and radius	Students solve a similar case in pairs
60 to 90 min	Group problem: check whether a proposed curve is acceptable against stated limits	Each group presents one finding
90 to 110 min	Short quiz on the session content	Marks recorded for formative tracking
110 to 120 min	Summary and homework: track gauge and transition curves	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 any instruction to students.

5.1 Concrete compressive strength (Materials laboratory)

Aim. Determine the compressive strength of hardened concrete cubes at a given age.

Equipment.

- Compression testing machine, calibrated
- Moulds (150 mm cubes), tamping rod, scoop
- Callipers, curing tank, weighing balance
- Personal protective equipment

Procedure.

1. Batch the concrete mix to the design proportions and record the batch quantities.
2. Fill the moulds in layers and compact each layer per the applicable standard (for example BS EN 12390 or ASTM C192 and C39).
3. Cover and label each cube with the date, mix and age.
4. Demould after the specified period and cure the cubes in water at the standard temperature.
5. At the test age, measure the dimensions and weight of each cube.
6. Place the cube centrally in the machine and load steadily until failure.
7. Record the failure load and calculate strength as load divided by the loaded area.

Safety.

- Use gloves and eye protection when handling wet concrete.
- Keep clear of the testing machine during loading.
- Report any cube that fails abnormally, with a sketch of the failure mode.

Report requirements. Include mix details, curing history, individual and mean strengths, and a comment on any abnormal result. Compare the mean strength with the design target.

5.2 Differential levelling (Engineering Surveying I)

Aim. Determine the reduced levels of stations along a traverse and check the misclosure.

Equipment.

- Dumpy or auto level, levelling staff, tripod
- Field book and pencil
- Calculator

Procedure.

1. Set up the level midway between the first two points, and level it accurately.
2. Take a backsight on the benchmark and record it.
3. Take foresights and intermediate sights to each point, moving the level as required.
4. Reduce the levels using the rise-and-fall or height-of-collimation method.
5. Check the arithmetic at each change point.
6. Close the loop on the benchmark and compute the misclosure.

Safety.

- Keep the staff vertical and steady.
- Avoid standing in the line of sight of the traffic.
- Work in pairs on roads and near moving plant.

Report requirements. Include the reduced levels, the misclosure and the permissible misclosure (for example 12 mm times the square root of the distance in km for ordinary levelling; confirm the departmental value). State whether the survey is acceptable.

5.3 Atterberg limits and sieve analysis (Soil Mechanics I)

Aim. Classify a soil sample by particle size distribution and plasticity.

Equipment.

- Sieve set and shaker
- Casagrande liquid limit device and grooving tool
- Glass plate, moisture cans, oven, balance

Procedure.

1. Oven-dry a representative sample and split it to the required mass.
2. Sieve the sample through the sieve set and record the mass retained on each sieve.
3. Calculate the percentage passing each sieve.
4. For the liquid limit, prepare paste, cut a groove and count blows to closure.
5. For the plastic limit, roll the soil into 3 mm threads until they crumble.
6. Compute the plasticity index as liquid limit minus plastic limit, and classify the soil.

Safety.

- Handle hot oven samples with heat-resistant gloves.
- Clean the Casagrande cup carefully and do not overfill.

Report requirements. Include the grading curve, the Atterberg limits and the classification with reference to the system used. Discuss any sources of error.

5.4 Asphalt mix design, Marshall method (Pavement Materials)

Aim. Determine the optimum bitumen content for a dense asphalt mix.

Equipment.

- Marshall compaction hammer and mould

- Marshall stability and flow apparatus
- Water bath, oven, balance, aggregate samples

Procedure.

1. Prepare aggregate blends at the specified gradings and bitumen contents.
2. Heat the aggregate and bitumen to the mixing temperatures.
3. Compact the specimens at the specified number of blows per face (commonly 75 for heavy traffic).
4. Measure the bulk density, and test the stability and flow after water-bath conditioning.
5. Plot the results and select the optimum bitumen content against the specification.

Safety.

- Bitumen fumes are hazardous; work in ventilated areas.
- Use heat-resistant gloves and face protection.

Report requirements. Include the mix properties, the plots, the optimum bitumen content and a comparison with the specification.

6. Assessment Design

6.1 Assessment blueprint for written examinations

Examinations should cover the course outcomes at the levels below. Adjust the weighting for practical courses, but record the chosen weights in the course file.

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

6.2 Design of continuous assessment

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

7. Rubrics

Rubrics are used for design projects, laboratory reports, oral defences and SIWES reports. Each criterion is scored from 1 to 4. The total is then 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 concept suited to the brief	Sound concept with minor gaps	Concept partly justified	Concept unclear or unsuitable
Calculations	Complete, correct and checked	Minor errors, method correct	Method partly correct	Major errors or missing
Use of standards	Correct codes applied and cited	Mostly applied correctly	Some codes misapplied	Standards not used
Drawings and specifications	Clear, complete and to convention	Minor omissions	Incomplete	Not usable

Criterion	4 Excellent	3 Good	2 Satisfactory	1 Unsatisfactory
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, processed correctly	Minor errors	Several errors	Major errors
Discussion	Insightful, sources of error analysed	Adequate discussion	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 answers	Mostly inaccurate
Professional judgement	Justifies trade-offs well	Justifies most decisions	Limited justification	No justification

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, selected across the mark range, with a second marker.
- Return feedback within the period set by the regulations, identifying strengths and specific next steps.
- Keep marked scripts and moderation records for the period required by the university.
- Record any change to a published mark, with the reason and the approver.

9. Supervision of Projects and SIWES

Final-year and research projects

- Supervisors meet each student at least every two weeks and keep a meeting log.
- Projects must have a written proposal approved before execution.
- Students submit a complete draft to the supervisor before the final submission.

SIWES

- Check each placement before the student starts, and record the supervisor's details.
- Visit or contact the placement at least once during the attachment, where feasible.
- Review the logbook and report, and complete the assessor's evaluation form.

10. Quality Assurance and Accreditation Readiness

- Keep the course file for each course: specification, scheme, assessment items, marking schemes, moderation records and feedback.
- Maintain a record 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.
- Use similarity-checking tools where the regulations require them.
- Report suspected misconduct through the department to the appropriate committee.
- Model professional ethics in your own practice, including honest reporting of data and clear acknowledgement of sources.