Students' Handbook

Civil Engineering: Railway, Tunnel and Transport Infrastructure Option

Faculty of Engineering, Akpakip Oro University (AOU)

Academic year: [to be inserted]

Draft for Faculty approval

1. Welcome

Welcome to the Department of Civil Engineering. This handbook explains the Railway, Tunnel and Transport Infrastructure option: what you will study, how you will be assessed, and where to get help. Read it alongside the university's academic regulations, which take precedence where they differ.

2. About the Programme

The option trains engineers to plan, design, build and maintain the systems that move people and goods: railways, road networks, tunnels and bridges. Years 1 and 2 build the shared foundations in mathematics, science, mechanics, materials and surveying. Years 3 to 5 add the transport and infrastructure specialisation, culminating in an integrated design project and defence.

Graduate profile

- Apply mathematics, science and engineering principles to infrastructure problems.
- Design and assess highways, railways, tunnels, bridges and foundations to applicable codes.
- Plan construction, control costs and manage quality and safety.
- Consider sustainability, climate resilience and asset management.
- Work ethically and communicate effectively in teams.

Career pathways

Graduates may work with railway and road agencies, tunnelling and civil contractors, engineering consultancies, materials and testing laboratories, and infrastructure regulators. Graduates who register with COREN may practise as professional engineers in Nigeria. Postgraduate study is also an option.

Professional registration

Registration with the Council for the Regulation of Engineering in Nigeria (COREN) requires an accredited qualification and professional experience. Keep your SIWES records and project reports, as they support your later registration.

3. Programme Structure

The table below lists every course, its units and the semester in which it is taken. Course codes and units are provisional and will be confirmed in the approved CCMAS schedule.

Year 1: Engineering Foundations

Semester 1

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
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

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

Semester 3

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

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

Semester 5

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

Code	Course	Units
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

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

Semester 7

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

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

Semester 9

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

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**

4. Course Specifications

Each entry gives the course description, learning outcomes, topics, assessment and recommended texts. Use the lecturer's teaching scheme for the week-by-week schedule.

Year 1: Engineering Foundations

CVE 101 Mathematics I

Units: 3 | Year 1, Semester 1 (First semester)

Description. Core algebra, calculus and coordinate geometry for engineering.

Learning outcomes:

- Solve algebraic and trigonometric problems
- Apply differentiation to engineering rates

Course topics:

1. Functions and graphs
2. Limits and differentiation
3. Integration techniques
4. Applications of calculus

Assessment: CA 30 / Exam 70

Recommended texts: Stroud and Booth, Engineering Mathematics (latest edition)

CVE 102 General Physics I

Units: 3 | Year 1, Semester 1 (First semester)

Description. Mechanics, waves and thermal physics for engineers.

Learning outcomes:

- Analyse forces, motion and energy
- Apply conservation laws to engineering systems

Course topics:

1. Kinematics and Newton's laws
2. Work, energy and momentum
3. Rotation and equilibrium
4. Oscillations and waves

Assessment: CA 30 / Exam 70

Recommended texts: Halliday, Resnick and Walker, Fundamentals of Physics (latest edition)

CVE 103 General Chemistry I

Units: 2 | Year 1, Semester 1 (First semester)

Description. Atomic structure, bonding and stoichiometry relevant to engineering materials.

Learning outcomes:

- Explain atomic structure and bonding
- Perform stoichiometric calculations

Course topics:

1. Atomic structure
2. Chemical bonding
3. Stoichiometry
4. Gases and solutions

Assessment: CA 30 / Exam 70

Recommended texts: Chang and Goldsby, General Chemistry (latest edition)

CVE 104 Introductory Engineering

Units: 2 | Year 1, Semester 1 (First semester)

Description. Overview of engineering disciplines, professional ethics and problem solving.

Learning outcomes:

- Describe engineering disciplines and roles
- Apply a structured problem-solving method

Course topics:

1. Engineering disciplines
2. Units and dimensions
3. Problem-solving methods
4. Professional ethics

Assessment: CA 50 / Exam 50

Recommended texts: Dym and Little, Engineering Design (latest edition)

CVE 105 Introduction to Computing

Units: 2 | Year 1, Semester 1 (First semester)

Description. Computer fundamentals, operating systems and productivity tools.

Learning outcomes:

- Use common computing tools effectively
- Explain computer system components

Course topics:

1. Computer hardware
2. Operating systems
3. Productivity tools
4. File and data management

Assessment: CA 60 / Exam 40

Recommended texts: Shelly and Vermaat, Discovering Computers (latest edition)

CVE 106 Communication in English

Units: 2 | Year 1, Semester 1 (First semester)

Description. Academic and technical writing, presentation and communication skills.

Learning outcomes:

- Write clear technical reports
- Deliver structured presentations

Course topics:

1. Academic writing
2. Technical reports
3. Presentation skills
4. Listening and comprehension

Assessment: CA 60 / Exam 40

Recommended texts: Swales and Feak, Academic Writing for Graduate Students (latest edition)

CVE 107 Engineering Laboratory Practicals

Units: 1 | Year 1, Semester 1 (First semester)

Description. Introductory measurement, error analysis and laboratory safety.

Learning outcomes:

- Record and analyse measurement data
- Apply laboratory safety procedures

Course topics:

1. Units and measurement
2. Error analysis
3. Data presentation
4. Laboratory safety

Assessment: Lab reports 100

Recommended texts: Institutional laboratory manual

CVE 108 Introduction to Civil Engineering

Units: 2 | Year 1, Semester 1 (First semester)

Description. Scope of civil engineering and its role in infrastructure development.

Learning outcomes:

- Describe civil engineering disciplines
- Discuss infrastructure and sustainability issues

Course topics:

1. Civil engineering disciplines
2. Infrastructure systems
3. Sustainable development
4. Professional bodies and careers

Assessment: CA 40 / Exam 60

Recommended texts: Departmental reading list, to be confirmed

CVE 109 Mathematics II

Units: 3 | Year 1, Semester 2 (Second semester)

Description. Matrices, series, vectors and differential equations.

Learning outcomes:

- Solve systems of linear equations
- Solve first and second order differential equations

Course topics:

1. Matrices and determinants
2. Vectors
3. Series
4. Ordinary differential equations

Assessment: CA 30 / Exam 70

Recommended texts: Stroud and Booth, Engineering Mathematics (latest edition)

CVE 110 General Physics II

Units: 3 | Year 1, Semester 2 (Second semester)

Description. Electricity, magnetism, optics and modern physics fundamentals.

Learning outcomes:

- Analyse electric and magnetic fields
- Apply optics and modern physics concepts

Course topics:

1. Electrostatics
2. Circuits
3. Magnetism
4. Optics and modern physics

Assessment: CA 30 / Exam 70

Recommended texts: Halliday, Resnick and Walker, Fundamentals of Physics (latest edition)

CVE 111 General Chemistry II

Units: 2 | Year 1, Semester 2 (Second semester)

Description. Thermochemistry, kinetics, equilibrium and electrochemistry.

Learning outcomes:

- Apply thermochemical and kinetic principles
- Explain chemical equilibrium

Course topics:

1. Thermochemistry
2. Kinetics
3. Equilibrium
4. Electrochemistry

Assessment: CA 30 / Exam 70

Recommended texts: Chang and Goldsby, General Chemistry (latest edition)

CVE 112 Engineering Drawing and Graphics

Units: 2 | Year 1, Semester 2 (Second semester)

Description. Orthographic projection, sectioning and dimensioning of engineering drawings.

Learning outcomes:

- Produce orthographic and sectional drawings
- Apply dimensioning and tolerancing conventions

Course topics:

1. Orthographic projection
2. Sections
3. Dimensioning
4. Isometric views

Assessment: Coursework 60 / Exam 40

Recommended texts: Giesecke et al., Technical Drawing (latest edition)

CVE 113 Programming and Engineering Computation

Units: 2 | Year 1, Semester 2 (Second semester)

Description. Structured programming and numerical methods for engineering problems.

Learning outcomes:

- Write structured programs for engineering problems
- Apply numerical methods

Course topics:

1. Programming basics
2. Control structures
3. Functions and arrays
4. Numerical methods

Assessment: CA 50 / Exam 50

Recommended texts: Chapra, Numerical Methods for Engineers (latest edition)

CVE 114 Nigerian Peoples and Cultures

Units: 2 | Year 1, Semester 2 (Second semester)

Description. Nigerian history, cultures and national development, or applicable general studies as prescribed.

Learning outcomes:

- Describe Nigerian cultural diversity
- Discuss national development issues

Course topics:

1. Nigerian history
2. Cultural diversity
3. Governance and development
4. Contemporary national issues

Assessment: CA 40 / Exam 60

Recommended texts: Departmental reading list, to be confirmed

CVE 115 Physics and Chemistry Practicals

Units: 1 | Year 1, Semester 2 (Second semester)

Description. Laboratory experiments reinforcing physics and chemistry theory.

Learning outcomes:

- Perform standard physics and chemistry experiments
- Write accurate laboratory reports

Course topics:

1. Experimental methods
2. Titrations
3. Physics experiments
4. Report writing

Assessment: Lab reports 100

Recommended texts: Institutional laboratory manual

CVE 116 Engineering Workshop and Safety

Units: 2 | Year 1, Semester 2 (Second semester)

Description. Workshop practice, hand and machine tools, and safety procedures.

Learning outcomes:

- Use common workshop tools safely
- Apply workplace safety standards

Course topics:

1. Workshop safety
2. Hand tools
3. Machine tools
4. Fabrication practice

Assessment: Practical 70 / Exam 30

Recommended texts: Institutional workshop manual

Year 2: Core Civil Engineering

CVE 201 Engineering Mechanics: Statics

Units: 3 | Year 2, Semester 3 (First semester)

Description. Equilibrium of particles and rigid bodies, trusses, frames and friction.

Learning outcomes:

- Analyse equilibrium of rigid bodies
- Determine forces in trusses and frames

Course topics:

1. Force systems
2. Equilibrium
3. Trusses
4. Friction

Assessment: CA 30 / Exam 70

Recommended texts: Hibbeler, Engineering Mechanics: Statics (latest edition)

CVE 202 Strength of Materials I

Units: 3 | Year 2, Semester 3 (First semester)

Description. Stress, strain and deformation of axially loaded members and beams.

Learning outcomes:

- Calculate stresses and strains
- Analyse bending and shear in beams

Course topics:

1. Stress and strain
2. Axial loading
3. Torsion
4. Bending and shear

Assessment: CA 30 / Exam 70

Recommended texts: Gere and Goodno, Mechanics of Materials (latest edition)

CVE 203 Engineering Surveying I

Units: 3 | Year 2, Semester 3 (First semester)

Description. Linear and angular measurement, levelling and traversing.

Learning outcomes:

- Perform levelling and traversing
- Process survey data

Course topics:

1. Linear measurement
2. Angles and bearings
3. Levelling
4. Traversing

Assessment: CA 40 / Exam 60

Recommended texts: Kavanagh, Surveying: Principles and Applications (latest edition)

CVE 204 Civil Engineering Drawing and CAD

Units: 2 | Year 2, Semester 3 (First semester)

Description. Drafting of civil works using CAD software.

Learning outcomes:

- Produce civil engineering drawings in CAD
- Apply drawing standards

Course topics:

1. CAD fundamentals
2. Plans and sections
3. Layers and annotation
4. Civil drawing standards

Assessment: Coursework 100

Recommended texts: Institutional CAD manual

CVE 205 Fluid Mechanics I

Units: 3 | Year 2, Semester 3 (First semester)

Description. Fluid properties, hydrostatics and conservation principles.

Learning outcomes:

- Calculate hydrostatic pressure and forces
- Apply continuity and Bernoulli principles

Course topics:

1. Fluid properties
2. Hydrostatics
3. Continuity
4. Bernoulli equation

Assessment: CA 30 / Exam 70

Recommended texts: Streeter, Wylie and Bedford, Fluid Mechanics (latest edition)

CVE 206 Building and Construction Technology

Units: 2 | Year 2, Semester 3 (First semester)

Description. Building components, construction methods and site practice.

Learning outcomes:

- Describe building components and methods
- Interpret construction specifications

Course topics:

1. Substructure
2. Superstructure
3. Construction methods
4. Site practice

Assessment: CA 40 / Exam 60

Recommended texts: Chudley and Greeno, Building Construction Handbook (latest edition)

CVE 207 Engineering Materials

Units: 2 | Year 2, Semester 3 (First semester)

Description. Properties and selection of metals, cement, aggregates and timber.

Learning outcomes:

- Select materials for civil applications
- Explain material properties and testing

Course topics:

1. Metals
2. Cement and aggregates
3. Timber
4. Material testing

Assessment: CA 40 / Exam 60

Recommended texts: Callister and Rethwisch, Materials Science and Engineering (latest edition)

CVE 208 Engineering Mathematics

Units: 3 | Year 2, Semester 3 (First semester)

Description. Partial derivatives, multiple integrals, Laplace transforms and Fourier series.

Learning outcomes:

- Apply Laplace transforms
- Use Fourier series in engineering problems

Course topics:

1. Partial derivatives
2. Multiple integrals
3. Laplace transforms
4. Fourier series

Assessment: CA 30 / Exam 70

Recommended texts: Kreyszig, Advanced Engineering Mathematics (latest edition)

CVE 209 Engineering Mechanics: Dynamics

Units: 3 | Year 2, Semester 4 (Second semester)

Description. Kinematics and kinetics of particles and rigid bodies.

Learning outcomes:

- Analyse motion of particles and rigid bodies
- Apply work-energy and impulse-momentum

Course topics:

1. Kinematics
2. Kinetics
3. Work and energy
4. Impulse and momentum

Assessment: CA 30 / Exam 70

Recommended texts: Meriam and Kraige, Engineering Mechanics: Dynamics (latest edition)

CVE 210 Strength of Materials II

Units: 3 | Year 2, Semester 4 (Second semester)

Description. Advanced stress analysis, columns and combined loading.

Learning outcomes:

- Analyse combined stresses
- Design for column buckling

Course topics:

1. Combined stresses
2. Beam deflection
3. Columns
4. Statically indeterminate members

Assessment: CA 30 / Exam 70

Recommended texts: Gere and Goodno (latest edition)

CVE 211 Engineering Surveying II

Units: 3 | Year 2, Semester 4 (Second semester)

Description. Triangulation, GNSS, control surveys and mapping.

Learning outcomes:

- Establish control networks
- Use GNSS for positioning

Course topics:

1. Triangulation
2. Total station
3. GNSS
4. Mapping and GIS basics

Assessment: CA 40 / Exam 60

Recommended texts: Kavanagh (latest edition)

CVE 212 Engineering Geology

Units: 2 | Year 2, Semester 4 (Second semester)

Description. Rock and soil formation, geological hazards and site investigation.

Learning outcomes:

- Identify common rocks and minerals
- Assess geological hazards for construction

Course topics:

1. Rock types
2. Geological structures
3. Groundwater
4. Hazards and site investigation

Assessment: CA 40 / Exam 60

Recommended texts: Waltham, Foundations of Engineering Geology (latest edition)

CVE 213 Fluid Mechanics II

Units: 3 | Year 2, Semester 4 (Second semester)

Description. Pipe flow, open channel flow and dimensional analysis.

Learning outcomes:

- Design pipe and channel systems
- Apply dimensional analysis

Course topics:

1. Pipe flow
2. Head losses
3. Open channel flow
4. Dimensional analysis

Assessment: CA 30 / Exam 70

Recommended texts: Streeter, Wylie and Bedford (latest edition)

CVE 214 Soil Mechanics I

Units: 3 | Year 2, Semester 4 (Second semester)

Description. Soil formation, classification, permeability and compaction.

Learning outcomes:

- Classify soils using standard tests
- Determine permeability and compaction characteristics

Course topics:

1. Soil formation
2. Index properties
3. Classification
4. Permeability and compaction

Assessment: CA 30 / Exam 70

Recommended texts: Craig, Craig's Soil Mechanics (latest edition)

CVE 215 Structural Analysis I

Units: 3 | Year 2, Semester 4 (Second semester)

Description. Analysis of determinate structures and influence lines.

Learning outcomes:

- Analyse determinate beams and frames
- Draw influence lines

Course topics:

1. Reactions and internal forces
2. Beams and frames
3. Influence lines
4. Deflection methods

Assessment: CA 30 / Exam 70

Recommended texts: Hibbeler, Structural Analysis (latest edition)

CVE 216 Introduction to Transportation Engineering

Units: 2 | Year 2, Semester 4 (Second semester)

Description. Transport modes, planning principles and transport demand.

Learning outcomes:

- Describe transport modes and systems
- Explain basic demand and planning concepts

Course topics:

1. Transport modes
2. Transport planning
3. Demand
4. Road and rail systems overview

Assessment: CA 40 / Exam 60

Recommended texts: Garber and Hoel, Traffic and Highway Engineering (latest edition)

Year 3: Transport and Infrastructure Engineering

CVE 301 Structural Analysis II

Units: 3 | Year 3, Semester 5 (First semester)

Description. Indeterminate structures using slope-deflection and moment distribution.

Learning outcomes:

- Analyse indeterminate beams and frames
- Apply matrix stiffness methods

Course topics:

1. Slope-deflection
2. Moment distribution
3. Matrix stiffness
4. Frame analysis

Assessment: CA 30 / Exam 70

Recommended texts: Hibbeler, Structural Analysis (latest edition)

CVE 302 Soil Mechanics II

Units: 3 | Year 3, Semester 5 (First semester)

Description. Effective stress, consolidation and shear strength of soils.

Learning outcomes:

- Calculate consolidation settlement
- Determine shear strength parameters

Course topics:

1. Effective stress
2. Consolidation
3. Shear strength
4. Slope stability introduction

Assessment: CA 30 / Exam 70

Recommended texts: Craig, Craig's Soil Mechanics (latest edition)

CVE 303 Highway Engineering I

Units: 3 | Year 3, Semester 5 (First semester)

Description. Highway geometric elements, alignment and road classification.

Learning outcomes:

- Design horizontal and vertical alignments
- Classify roads by function

Course topics:

1. Road classification
2. Horizontal alignment
3. Vertical alignment
4. Sight distance

Assessment: CA 40 / Exam 60

Recommended texts: Garber and Hoel (latest edition)

CVE 304 Transportation Engineering

Units: 2 | Year 3, Semester 5 (First semester)

Description. Transport systems operation, capacity and traffic flow.

Learning outcomes:

- Analyse traffic flow parameters
- Evaluate transport system capacity

Course topics:

1. Traffic flow theory
2. Capacity
3. Transport operations
4. Public transport

Assessment: CA 40 / Exam 60

Recommended texts: Mannering, Principles of Highway Engineering and Traffic Analysis (latest edition)

CVE 305 Engineering Surveying and Setting Out

Units: 2 | Year 3, Semester 5 (First semester)

Description. Setting out of roads, railways, structures and tunnels.

Learning outcomes:

- Set out horizontal and vertical alignments
- Apply setting-out tolerances

Course topics:

1. Setting out principles
2. Curve setting
3. Structure setting out
4. Tolerances

Assessment: Practical 60 / Exam 40

Recommended texts: Kavanagh (latest edition)

CVE 306 Geotechnical Engineering

Units: 3 | Year 3, Semester 5 (First semester)

Description. Site investigation, slope stability and earth pressure.

Learning outcomes:

- Plan site investigations
- Assess slope stability and earth pressure

Course topics:

1. Site investigation
2. Earth pressure
3. Retaining walls
4. Slope stability

Assessment: CA 30 / Exam 70

Recommended texts: Das, Principles of Geotechnical Engineering (latest edition)

CVE 307 Construction Engineering

Units: 2 | Year 3, Semester 5 (First semester)

Description. Construction planning, methods and plant selection.

Learning outcomes:

- Prepare construction programmes
- Select construction methods and plant

Course topics:

1. Planning and scheduling
2. Construction methods
3. Plant and equipment
4. Site organisation

Assessment: CA 40 / Exam 60

Recommended texts: Halpin and Senior, Construction Management (latest edition)

CVE 308 Engineering Statistics and Research Methods

Units: 2 | Year 3, Semester 5 (First semester)

Description. Statistical methods and research design for engineering.

Learning outcomes:

- Apply descriptive and inferential statistics
- Design and report simple experiments

Course topics:

1. Descriptive statistics
2. Probability
3. Hypothesis testing
4. Research design

Assessment: CA 40 / Exam 60

Recommended texts: Montgomery and Runger, Applied Statistics and Probability for Engineers (latest edition)

CVE 309 Reinforced Concrete Design I

Units: 3 | Year 3, Semester 6 (Second semester)

Description. Design of beams, slabs and columns to limit-state principles.

Learning outcomes:

- Design reinforced concrete beams and slabs
- Check serviceability requirements

Course topics:

1. Concrete and steel properties
2. Limit states
3. Beam design
4. Slab design

Assessment: CA 30 / Exam 70

Recommended texts: Nilson, Design of Concrete Structures (latest edition)

CVE 310 Foundation Engineering

Units: 3 | Year 3, Semester 6 (Second semester)

Description. Shallow and deep foundations, bearing capacity and settlement.

Learning outcomes:

- Design shallow foundations
- Estimate pile capacity and settlement

Course topics:

1. Bearing capacity
2. Settlement
3. Shallow foundations
4. Pile foundations

Assessment: CA 30 / Exam 70

Recommended texts: Das, Principles of Foundation Engineering (latest edition)

CVE 311 Highway Engineering II

Units: 3 | Year 3, Semester 6 (Second semester)

Description. Pavement design, flexible and rigid pavement structures.

Learning outcomes:

- Design flexible and rigid pavements
- Evaluate pavement performance

Course topics:

1. Pavement structure
2. Flexible design
3. Rigid design
4. Performance evaluation

Assessment: CA 30 / Exam 70

Recommended texts: Huang, Pavement Analysis and Design (latest edition)

CVE 312 Pavement Materials and Asphalt Technology

Units: 2 | Year 3, Semester 6 (Second semester)

Description. Bitumen, asphalt mix design and aggregate testing.

Learning outcomes:

- Test bitumen and aggregates
- Carry out asphalt mix design

Course topics:

1. Bitumen properties
2. Aggregate tests
3. Asphalt mix design
4. Quality control

Assessment: Lab 60 / Exam 40

Recommended texts: Asphalt Institute manual (latest edition)

CVE 313 Engineering Hydrology

Units: 2 | Year 3, Semester 6 (Second semester)

Description. Rainfall, runoff and flood estimation for infrastructure.

Learning outcomes:

- Estimate design rainfall and runoff
- Apply flood frequency analysis

Course topics:

1. Precipitation
2. Infiltration
3. Runoff
4. Flood frequency

Assessment: CA 40 / Exam 60

Recommended texts: Chow, Maidment and Mays, Applied Hydrology (latest edition)

CVE 314 Highway Drainage and Erosion Control

Units: 2 | Year 3, Semester 6 (Second semester)

Description. Drainage design and erosion control for road infrastructure.

Learning outcomes:

- Design road drainage systems
- Specify erosion control measures

Course topics:

1. Drainage design
2. Culverts
3. Erosion
4. Control measures

Assessment: CA 40 / Exam 60

Recommended texts: Departmental reading list, to be confirmed

CVE 315 Railway Engineering I

Units: 3 | Year 3, Semester 6 (Second semester)

Description. Track components, track geometry and railway formation.

Learning outcomes:

- Describe track components and geometry
- Design formation and drainage

Course topics:

1. Track components
2. Track geometry
3. Formation
4. Drainage

Assessment: CA 40 / Exam 60

Recommended texts: Profillidis, Railway Engineering (latest edition)

CVE 316 Tunnel Engineering Fundamentals

Units: 3 | Year 3, Semester 6 (Second semester)

Description. Tunnel types, ground conditions and basic excavation methods.

Learning outcomes:

- Classify ground for tunnelling
- Describe excavation and support methods

Course topics:

1. Tunnel types
2. Ground classification
3. Excavation
4. Support basics

Assessment: CA 40 / Exam 60

Recommended texts: Hoek and Brown, Underground Excavations in Rock (latest edition)

Year 4: Advanced Design and Industrial Practice

CVE 401 Reinforced Concrete Design II

Units: 3 | Year 4, Semester 7 (First semester)

Description. Design of frames, walls and staircases to current codes.

Learning outcomes:

- Design reinforced concrete frames
- Detail reinforcement drawings

Course topics:

1. Frames
2. Walls
3. Staircases
4. Detailing

Assessment: CA 30 / Exam 70

Recommended texts: Nilson, Design of Concrete Structures (latest edition)

CVE 402 Steel Structures

Units: 3 | Year 4, Semester 7 (First semester)

Description. Design of steel members and connections.

Learning outcomes:

- Design steel tension and compression members
- Design bolted and welded connections

Course topics:

1. Tension members
2. Compression members
3. Beams
4. Connections

Assessment: CA 30 / Exam 70

Recommended texts: McCormac and Csernak, Structural Steel Design (latest edition)

CVE 403 Highway Geometric Design

Units: 3 | Year 4, Semester 7 (First semester)

Description. Advanced alignment design, junctions and interchanges.

Learning outcomes:

- Design junctions and interchanges
- Apply geometric standards

Course topics:

1. Junction design
2. Interchanges
3. Geometric standards
4. Cross-section design

Assessment: Design project 60 / Exam 40

Recommended texts: Garber and Hoel (latest edition)

CVE 404 Railway Engineering II

Units: 3 | Year 4, Semester 7 (First semester)

Description. Turnouts, railway operations and railway maintenance planning.

Learning outcomes:

- Design turnouts and layouts
- Plan railway maintenance

Course topics:

1. Turnouts
2. Operations
3. Maintenance planning
4. Capacity

Assessment: CA 40 / Exam 60

Recommended texts: Profillidis (latest edition)

CVE 405 Traffic Engineering and Road Safety

Units: 2 | Year 4, Semester 7 (First semester)

Description. Traffic control, safety audits and accident analysis.

Learning outcomes:

- Design traffic control measures
- Conduct road safety audits

Course topics:

1. Traffic control
2. Signals
3. Safety audits
4. Accident analysis

Assessment: CA 40 / Exam 60

Recommended texts: Mannering et al., Principles of Highway Engineering and Traffic Analysis (latest edition)

CVE 406 Construction Project Management

Units: 2 | Year 4, Semester 7 (First semester)

Description. Project planning, control, risk and cost management.

Learning outcomes:

- Plan and control construction projects
- Assess project risks

Course topics:

1. Project planning
2. Scheduling
3. Cost control
4. Risk management

Assessment: CA 40 / Exam 60

Recommended texts: Gould and Joyce, Construction Project Management (latest edition)

CVE 407 Environmental Engineering

Units: 2 | Year 4, Semester 7 (First semester)

Description. Water supply, wastewater and environmental impact in infrastructure.

Learning outcomes:

- Assess environmental impact of projects
- Describe water and wastewater treatment

Course topics:

1. Water supply
2. Wastewater
3. Impact assessment
4. Pollution control

Assessment: CA 40 / Exam 60

Recommended texts: Davis and Cornwell, Introduction to Environmental Engineering (latest edition)

CVE 408 Research Project I

Units: 2 | Year 4, Semester 7 (First semester)

Description. Literature review and proposal for the final-year project.

Learning outcomes:

- Conduct a literature review
- Write a research proposal

Course topics:

1. Literature search
2. Research questions
3. Methodology
4. Proposal writing

Assessment: Proposal 100

Recommended texts: Supervisor guidance and departmental guide

CVE 409 Bridge Engineering

Units: 3 | Year 4, Semester 8 (Second semester)

Description. Bridge types, loading and design principles.

Learning outcomes:

- Describe bridge types and loading
- Design simple bridge elements

Course topics:

1. Bridge types
2. Loading
3. Superstructure
4. Substructure

Assessment: CA 30 / Exam 70

Recommended texts: Chen and Duan, Bridge Engineering Handbook (latest edition)

CVE 410 Advanced Pavement Design

Units: 3 | Year 4, Semester 8 (Second semester)

Description. Advanced pavement design methods and rehabilitation.

Learning outcomes:

- Apply advanced pavement design methods
- Design rehabilitation strategies

Course topics:

1. Design methods
2. Overlay design
3. Rehabilitation
4. Material selection

Assessment: CA 30 / Exam 70

Recommended texts: Huang (latest edition)

CVE 411 Road Construction and Maintenance

Units: 2 | Year 4, Semester 8 (Second semester)

Description. Construction processes, maintenance strategies and quality.

Learning outcomes:

- Plan road construction
- Select maintenance strategies

Course topics:

1. Construction processes
2. Maintenance
3. Quality control
4. Equipment

Assessment: CA 40 / Exam 60

Recommended texts: Departmental reading list, to be confirmed

CVE 412 Tunnel Construction and Support Systems

Units: 3 | Year 4, Semester 8 (Second semester)

Description. Tunnel excavation, ground support and lining design.

Learning outcomes:

- Design tunnel support systems
- Select excavation methods

Course topics:

1. Excavation methods
2. Ground support
3. Linings
4. Monitoring

Assessment: CA 30 / Exam 70

Recommended texts: Bickel, Kuesel and King, Tunnel Engineering Handbook (latest edition)

CVE 413 Transportation Infrastructure Planning

Units: 2 | Year 4, Semester 8 (Second semester)

Description. Strategic planning and appraisal of transport infrastructure.

Learning outcomes:

- Appraise transport projects
- Apply planning models

Course topics:

1. Planning process
2. Demand models
3. Appraisal
4. Stakeholders

Assessment: CA 40 / Exam 60

Recommended texts: Ortuzar and Willumsen, Modelling Transport (latest edition)

CVE 414 Construction Contracts and Cost Estimation

Units: 2 | Year 4, Semester 8 (Second semester)

Description. Contract types, tendering and estimating methods.

Learning outcomes:

- Prepare cost estimates
- Explain contract types and obligations

Course topics:

1. Contract types
2. Tendering
3. Estimating
4. Claims

Assessment: CA 40 / Exam 60

Recommended texts: Departmental reading list, to be confirmed

CVE 415 Infrastructure Asset Management

Units: 2 | Year 4, Semester 8 (Second semester)

Description. Asset inventory, condition assessment and lifecycle planning.

Learning outcomes:

- Plan asset lifecycles
- Assess asset condition

Course topics:

1. Asset inventory
2. Condition rating
3. Lifecycle costing
4. Prioritisation

Assessment: CA 40 / Exam 60

Recommended texts: Hudson, Haas and Uddin, Infrastructure Management (latest edition)

CVE 416 Industrial Training (SIWES)

Units: 3 | Year 4, Semester 8 (Second semester)

Description. Supervised industrial attachment in a relevant organisation.

Learning outcomes:

- Apply engineering knowledge in practice
- Keep a professional logbook

Course topics:

1. Workplace induction
2. Practical tasks
3. Reporting
4. Professional conduct

Assessment: Logbook 40 / Report 40 / Assessor 20

Recommended texts: SIWES guidelines issued by the Industrial Training Fund and AOU

Year 5: Specialisation, Integration and Professional Readiness

CVE 501 Advanced Highway Design

Units: 3 | Year 5, Semester 9 (First semester)

Description. Integrated design of highway projects with safety and cost criteria.

Learning outcomes:

- Produce integrated highway designs
- Justify design decisions

Course topics:

1. Design integration
2. Safety
3. Cost
4. Documentation

Assessment: Design project 60 / Exam 40

Recommended texts: Garber and Hoel (latest edition)

CVE 502 Highway Rehabilitation and Asset Management

Units: 2 | Year 5, Semester 9 (First semester)

Description. Condition-based rehabilitation and pavement management systems.

Learning outcomes:

- Apply pavement management systems
- Prioritise rehabilitation works

Course topics:

1. Pavement management
2. Condition surveys
3. Prioritisation
4. Funding

Assessment: CA 40 / Exam 60

Recommended texts: Hudson, Haas and Uddin (latest edition)

CVE 503 Advanced Geotechnical Engineering

Units: 3 | Year 5, Semester 9 (First semester)

Description. Advanced slope, embankment and ground improvement design.

Learning outcomes:

- Design ground improvement measures
- Analyse slope stability

Course topics:

1. Ground improvement
2. Slope stability
3. Embankments
4. Monitoring

Assessment: CA 30 / Exam 70

Recommended texts: Das (latest edition)

CVE 504 Sustainable and Climate-Resilient Infrastructure

Units: 2 | Year 5, Semester 9 (First semester)

Description. Design for climate change, resilience and sustainability.

Learning outcomes:

- Assess climate risks to infrastructure
- Apply sustainability criteria

Course topics:

1. Climate risk
2. Resilience
3. Materials and carbon
4. Sustainability assessment

Assessment: CA 40 / Exam 60

Recommended texts: Departmental reading list, to be confirmed

CVE 505 Pavement Evaluation and Quality Control

Units: 2 | Year 5, Semester 9 (First semester)

Description. Pavement testing, evaluation and quality assurance.

Learning outcomes:

- Conduct pavement evaluation
- Implement quality control plans

Course topics:

1. Deflection testing
2. Roughness
3. Quality plans
4. Specifications

Assessment: Lab/project 60 / Exam 40

Recommended texts: Asphalt Institute manual (latest edition)

CVE 506 Transport Infrastructure Economics

Units: 2 | Year 5, Semester 9 (First semester)

Description. Cost-benefit analysis and economic appraisal of transport projects.

Learning outcomes:

- Perform cost-benefit analysis
- Evaluate funding options

Course topics:

1. Cost-benefit analysis
2. Discounting
3. Funding
4. Risk

Assessment: CA 40 / Exam 60

Recommended texts: Departmental reading list, to be confirmed

CVE 507 Research Project II

Units: 3 | Year 5, Semester 9 (First semester)

Description. Execution, analysis and reporting of the final-year research project.

Learning outcomes:

- Execute a research project
- Report findings to professional standard

Course topics:

1. Data collection
2. Analysis
3. Writing
4. Oral presentation

Assessment: Project 100

Recommended texts: Supervisor guidance and departmental guide

CVE 508 Technical Elective I

Units: 2 | Year 5, Semester 9 (First semester)

Description. Elective selected from the approved railway, tunnel and transport list.

Learning outcomes:

- Apply specialist knowledge in the chosen area
- Evaluate case studies

Course topics:

1. Selected topic
2. Case studies
3. Applications
4. Review

Assessment: CA 40 / Exam 60

Recommended texts: As specified for the chosen elective

CVE 509 Integrated Transport Infrastructure Design

Units: 3 | Year 5, Semester 10 (Second semester)

Description. Capstone integration of highway, railway, tunnel and bridge elements.

Learning outcomes:

- Integrate multiple infrastructure elements
- Produce a coordinated design

Course topics:

1. Integration
2. Coordination
3. Design documentation
4. Review

Assessment: Design project 100

Recommended texts: Departmental design brief

CVE 510 Railway and Highway Systems Integration

Units: 3 | Year 5, Semester 10 (Second semester)

Description. Interfaces between rail and road networks, level crossings and corridors.

Learning outcomes:

- Design rail-road interfaces
- Assess corridor integration

Course topics:

1. Level crossings
2. Corridors
3. Interfaces
4. Multimodal planning

Assessment: CA 40 / Exam 60

Recommended texts: Profillidis (latest edition)

CVE 511 Advanced Bridge or Tunnel Design

Units: 3 | Year 5, Semester 10 (Second semester)

Description. Advanced design of a bridge or tunnel, as selected by the student.

Learning outcomes:

- Design a complex bridge or tunnel element
- Justify design assumptions

Course topics:

1. Advanced loading
2. Design method
3. Detailing
4. Checking

Assessment: CA 30 / Exam 70

Recommended texts: Chen and Duan, or Bickel et al., as applicable

CVE 512 Infrastructure Risk and Safety Management

Units: 2 | Year 5, Semester 10 (Second semester)

Description. Risk assessment and safety management for infrastructure projects.

Learning outcomes:

- Conduct risk assessments
- Develop safety management plans

Course topics:

1. Hazard identification
2. Risk assessment
3. Safety plans
4. Monitoring

Assessment: CA 40 / Exam 60

Recommended texts: Departmental reading list, to be confirmed

CVE 513 Construction Quality Assurance

Units: 2 | Year 5, Semester 10 (Second semester)

Description. Quality systems, inspection and testing in construction.

Learning outcomes:

- Implement quality assurance systems
- Plan inspection and testing

Course topics:

1. Quality systems
2. Inspection
3. Testing
4. Documentation

Assessment: CA 40 / Exam 60

Recommended texts: Departmental reading list, to be confirmed

CVE 514 Engineering Professional Practice and Ethics

Units: 2 | Year 5, Semester 10 (Second semester)

Description. Professional conduct, registration, ethics and engineering law.

Learning outcomes:

- Apply professional ethics
- Describe registration and legal responsibilities

Course topics:

1. Ethics
2. Professional bodies
3. Registration
4. Engineering law

Assessment: CA 50 / Exam 50

Recommended texts: Departmental reading list, to be confirmed

CVE 515 Final-Year Design Project and Defence

Units: 4 | Year 5, Semester 10 (Second semester)

Description. Culminating integrated design project with formal defence.

Learning outcomes:

- Produce a complete design project
- Defend design decisions orally

Course topics:

1. Design development
2. Documentation
3. Presentation
4. Defence

Assessment: Project 60 / Defence 40

Recommended texts: Departmental project guide

CVE 516 Technical Elective II

Units: 2 | Year 5, Semester 10 (Second semester)

Description. Second elective from the approved railway, tunnel and transport list.

Learning outcomes:

- Apply specialist knowledge in the chosen area
- Evaluate case studies

Course topics:

1. Selected topic
2. Case studies
3. Applications
4. Review

Assessment: CA 40 / Exam 60

Recommended texts: As specified for the chosen elective

5. Industrial Training (SIWES)

- SIWES is taken in Year 4, Semester 8, for 3 units.
- Keep a daily or weekly logbook that records tasks, supervision and what you learned.
- Obtain the placement letter and supervisor details before you start.
- Your final report and assessor's evaluation are part of your assessment.
- Follow the Industrial Training Fund and AOU SIWES guidelines throughout.

6. Assessment and Academic Regulations

Assessment follows the university's approved academic regulations, which govern grading, attendance, progression, carry-over and classification. This summary does not replace those regulations.

- Continuous assessment (CA) is set by course. Examinations form the remainder unless a course states otherwise.
- Practical and laboratory courses are assessed on reports, practical work and, where stated, a viva.
- Design projects and the final-year defence are assessed by a panel using published rubrics.
- Report any missed assessment through the department as soon as possible, with supporting evidence.
- Grading and classification are as set out in the regulations: [insert AOU grading table].

7. Student Support and Conduct

- **Academic advising:** each student is assigned an adviser. Meet your adviser at least once a semester.
- **Library and resources:** codes, standards and textbooks are listed in course specifications.
- **Academic integrity:** plagiarism, falsified data and unauthorised collaboration are serious offences.
- **Respect and inclusion:** treat staff, colleagues and communities with dignity; report harassment through the appropriate channel.
- **Wellbeing:** seek help early from your adviser or the university welfare services.

8. Laboratory, Workshop and Field Safety

- Wear the prescribed personal protective equipment (PPE) at all times in laboratories, workshops and on sites.
- Follow the instructions of the technician and lecturer. Never operate equipment you have not been trained to use.
- Report every accident, near miss and damaged equipment immediately.
- On field visits, follow the site rules, wear high-visibility clothing and stay with your group.
- Know the location of first-aid equipment and the emergency exits.

9. Contacts

Role	Name	Contact
Head of Department	[to be inserted]	[to be inserted]
Programme coordinator (RTTI option)	[to be inserted]	[to be inserted]
Level advisers	[to be inserted]	[to be inserted]
SIWES coordinator	[to be inserted]	[to be inserted]
Laboratory technical officer	[to be inserted]	[to be inserted]