Stellenbosch UNIVERSITY IYUNIVESITHI UNIVERSITEIT

forward together
sonke siya phambili
saam vorentoe

Postgraduate modules: Department of Civil Engineering

UPDATE: 03 February 2026

This document describes postgraduate modules offered to students of the Department of Civil Engineering of Stellenbosch University. Modules are presented annually or biannually. An indication of the year in which a module is anticipated to be presented is indicated in the Module Summary below, however, presentation years are subject to change. Please refer to our website (su.ac.za/civil) or this link Civil Engineering - Current Postgraduates for the list of modules presented in each year.

Module Summary

Package	Module Code	Module Name	2025	2026	2027	2028
FACULTY MODULES	11748-873	Advanced Topics in Engineering Management	X	X	X	X
	14190-874	Data Science	X	X	X	X
	36323-876	Numerical Methods	X	X	X	X
	58157-812	Project Economics and Finance	X	X	X	X
	51993-873	Project Management	X	X	X	X
FIRE ENG.	14769-874	Fire Engineering I		X		X
	14772-874	Fire Engineering II	X		X	
	14770-874	Techniques in Fire Engineering	X		X	
	14002-874	Fire Behaviour	X	X	X	X
	14003-874	Structural Fire Engineering		X		X
GEOTECH. ENG.	10809-812	Advanced Geotechnics	X		X	
	10814-812	Applied Geomechanics		X		X
	10829-812	Foundation Design	X	X	X	X
	10861-842	Soil Behaviour		X		X
PAVEMENT ENG.	10785-812	Advanced Bitumen Technology	X		X	
	11206-812	Pavement Evaluation and Rehabilitation		X		X
	10844-842	Pavement Management Systems		X		X
	10845-812	Pavement Materials I	X		X	
	10846-812	Pavement Materials II	X		X	
	10848-842	Pavement Materials III		X		X
STRUCT-URAL ENG.	10810-812	Advanced Structural Concrete Design	X		X	X
	10811-812	Advanced Structural Steel Design		X		X
	10866-812	Structural Dynamics	X	X		X
TRANSPORTATION ENG.	10831-812	Geometric Road Design		X		X
	13004-841	Intelligent Transport Systems	X		X	
	10853-842	Public Transport	X		X	
	10875-812	Traffic Flow Theory	X		X	
	10877-812	Transportation Planning		X		X
	10878-812	Transportation Safety	X		X	

Engineering Faculty modules

Faculty modules are presented annually. These five modules form the core of all MEng(Structured) programmes throughout the Faculty of Engineering. MEng(S) students take three of these five core modules, as well as an additional five modules specific to their discipline.

11748-873 (15) Advanced Topics in Engineering Management

Host department: Industrial Engineering

The purpose of the module is to present principles of general management within the context of technical disciplines. The module themes include the business environment and strategic management on a firm level, touching on the role of innovation and technology for competitiveness on a systems level from international and national perspectives. The module will include a significant focus on tools and techniques for technology and innovation management, exploring the link between technology management and business management taking a capabilities approach. These capabilities include acquisition, protection, exploitation, identification and selection. We relate traditional approaches to technology management to what it means for the context of the fourth industrial revolution, platform economies and innovation platforms. The functions of engineering management, namely planning, organising, leading and controlling will also be discussed. This includes a focus on human resource management, insofar as managing projects, people and groups is concerned, as well as aspects of labour relations and specifically the labour law and contractual requirements in South Africa.

14190-874 (15) Data Science

Host department: Industrial Engineering

Data science is the application of computational, statistical, and machine learning techniques to gain insight into real world problems. The focus of this module is on the data science project life cycle, specifically to gain a clear understanding of the five steps in the data science process, namely obtain, scrub/wrangling, explore, model, and interpret. Each of these steps will be studied with the main purpose to gain an understanding of the requirements, complexities, and tools to apply to each of these life cycle steps. Students will understand the process of constructing a data pipeline, from raw data to knowledge. Case studies from the engineering domain will be used to explore each of these steps.

36323-876 (15) Numerical Methods

Host department: Applied Mathematics, Faculty of Science

The module focuses on matrix computations. We study the effective solution of linear systems, involving both square and rectangular matrices (least-squares). Direct as well as iterative methods are considered, with the emphasis on sparse matrices and matrices with structure. Numerical methods for the eigenvalue problem are also considered. Pitfalls such as numerical instability and ill-conditioning are pointed out. Model problems are taken from partial differential equations, data analysis and image processing. Theory, algorithmic aspects, and applications are emphasized in equal parts

58157-812 (15) Project Economics and Finance

Host department: Civil Engineering

The module focuses on how to finance a business opportunity (project) that can be isolated from the rest of a company's business activities. Financing through a combination of debt and equity are discussed, based on the future profitability of the project where project cash flow is the main source

of capital recovery, and the project assets are the only collateral. The concepts of construction loans and public- private partnerships are discussed. A number of case studies will be covered in the module, including projects to construct a bridge, a satellite and a wind turbine farm. Current module content includes: infrastructure and development finance, time value of money, basic accounting statements, ratio analysis, economic analysis of investment decisions, market valuation (EVA and MVA), the national accounts and economic growth, feasibility studies and techno economic analysis, risk and uncertainty in infrastructure finance and project development.

51993-873 (15) Project Management

Host department: Industrial Engineering

The module focuses on advanced topics in project management, and it is expected that participants have either attended a project management module or have experience in managing projects. The module builds on the traditional project scheduling by addressing critical chain management and looks at managing project risks through the identification and assessment of risk potentials and mitigating strategies, including resource / cost management and contingency planning. The selection of appropriate teams and structures to facilitate contract management are discussed, along with executing project leadership through proper communication channels. The importance of procurement, from tender procedures through to supplier selection will be highlighted. The different nuances between commercial and research projects will be explained.

Fire Engineering

Package coordinator: Prof Richard Walls

14769-874 (15) Fire Engineering I

Practical applications of the fundamentals of fire science. This module focuses on the design of systems that ensure safe conditions for people during a fire incident. Specific topics covered include: fire safety design; fire detection and alarm systems; smoke management; and evacuation and human movement principles.

14772-874 (15) Fire Engineering II

This module focuses on understanding different risks and the design of suppression systems that ensure safe conditions during a fire incident. Specific topics covered include: material and product behaviour in fire; hazard and risk analysis; suppression systems and design; and performance-based design.

14770-874 (15) Techniques in Fire Engineering

This module is designed to develop an understanding of experimental and numerical techniques in fire engineering. Students will develop a sound knowledge and experimental understanding of fire safety systems, their operations, fire behaviour, and fire tests. Students will learn to apply numerical techniques to solve fire dynamic problems with the use of tools such a zonal models and computational fluid dynamics (CFD).

14002-874 (15) Fire Behaviour

The physics and engineering aspects of fire and fire protection engineering. This module serves as the foundation for students wishing to go into structural fire engineering design or traditional fire engineering. Specific topics addressed are: thermochemistry; heat transfer; fire plumes and smoke behaviour; steady burning of liquids; ignition and initiation of burning; spread of flame; and pre-and post-flashover compartments.

14003-874 (15) Structural Fire Engineering

This is a structural design module in which students develop the ability to understand the complex nature of fire and how structures respond in the event of a fire. The module has been designed to be suitable for engineers from a variety of backgrounds, and not only structural engineers. The ultimate aim is to ensure that engineers can ensure structural safety, by analysing how materials and systems respond to elevated temperatures. Specific topics covered include: fires and heat; fire severity and fire resistance; design of structures for fire; steel, concrete and timber structures; and general structures (composite, facades, etc.).

Geotechnical Engineering

Package coordinator: Prof Charles MacRobert

10809-812 (15) Advanced Geotechnics

This course covers sources of uncertainty in geotechnical engineering including stratigraphy, soil properties, calculation model and other uncertainties. Means to account for uncertainty in design such as basic statistics, limit states design including the selection of characteristic and design values, reliability analysis and risk assessments are then presented. These tools are applied to the design of shallow foundations, pile foundations, retaining walls and slopes.

10814-812 (15) Applied Geomechanics

This course covers the prediction of shear strength of granular soils, silts, clays, and municipal waste for use in slope stability analysis with an emphasis on in-situ testing. Calculation methods including hand calculations, limit equilibrium methods and finite element methods are presented along with an introduction to seepage modelling. Slope stabilisation, factors of safety and reliability are also covered. The module also includes a series of guest lectures focusing on case studies showing how taught theories are applied in practical geomechanics.

10829-812 (15) Foundation Design

This course covers geotechnical investigations including requirements for problem soils, parameter selection, loads and load combinations, damage and limiting settlements, bearing capacity and settlement of shallow foundations, load capacity and settlement of piles, pile groups, raft foundations and large-scale load tests. This is a practical course that is aligned with current industry practice. It is suitable for post-graduate students and practitioners of structural and geotechnical engineering.

10861-842 (15) Soil Behaviour

What makes soil behave the way it does? Soil is a particulate material and the interaction between individual particles and the voids between them results in the behaviour of soil being a function of the stresses and void ratio. Critical state soil mechanics provides a framework that unifies shear and consolidation behaviour of soils and allows prediction of soil strength and deformation as a function of initial state, loading and drainage conditions. In this course participants will learn the theory defining the critical state line and constitutive models based on this theory, namely Cam-Clay and NorSand. Practical application will focus on the use of the state parameter in predicting dilative and contractive behaviour, particularly in assessing static liquefaction potential and stability of tailings storage facilities.

Pavement Engineering

Package coordinator: Prof Kim Jenkins

10785-812 (15) Advanced Bitumen Technology

Applications and developments in the field of bituminous binders, including bond and tack coats, emulsions, seal binders, asphalt binders, modified binders, and alternative binders e.g. bio-binders. Binder rheology and appropriate test methods are modelled. The link between binder parameters, binder ageing, and binder performance is covered. Recent international developments in binder technology, mastics, modifiers, biofuels will be shared, covering production to design and application.

11206-812 (15) Pavement Evaluation and Rehabilitation

Pavement materials, design principles and methods refresher. Functional/structural: pavement distress approach (including roughness and friction). Performance of pavement types. The rehabilitation process (TRH12). Functional/structural evaluation. Network and project level evaluation. Condition surveys: visual inspection and use instruments. Condition assessment (TMH9): performance criteria for the evaluation of pavements. Drainage evaluation. Sub grade and pavement materials evaluation. Traffic loading evaluation. Structural evaluation using non-destructive testing. Deflection measurement, analysis, interpretation and application. Rehabilitation design of flexible pavements. Pavement overlay design. Recycling. Empirically and theoretically derived rehabilitation approaches used in SA. Economic Analysis. Accelerated Pavement Testing. Surface rehabilitation techniques for flexible pavements, including construction aspects.

10844-842 (15) Pavement Management Systems

Pavement systems, monitoring of distress and deterioration, establishment of appropriate performance models and limiting criteria. Validation of design methods, diagnostic methods. Rehabilitation design. Pavement Management systems, tools and methods for data acquisition, visual inspections, use of functional and structural measurements, maintenance and rehabilitation strategies, economic analysis including road user costs, prioritisation and optimisation procedures, programming and case studies. In addition, specifically for Gravel Road Management: Structural capacity; Basic material properties and gravel performance modelling; Soil stabilizers; Visual condition assessment; Pavement condition description; Appropriate maintenance measures; HDM for unsurfaced Road Management; Borrow pits and environmental issues.

10845-812 (15) Pavement Materials I – Granular and Cemented Materials

The use of natural and crushed soils and rocks as road foundation and layerworks in pavement structures. Relevant climatic considerations and problem areas. Compaction theory, practise and laboratory versus field considerations. Laboratory and field testing of materials that are processed, modified, stabilized or cemented. Engineering and behavioural characteristics – environmental and loading considerations. Case studies including diagnostic investigations. Inclusion of latest practise – local and relevant international trends.

10846-812 (15) Pavement Materials II – Asphalt

Rheology of bituminous binders and mixes related to performance. Bitumen refining and chemical properties, tests and specifications (standard and modified binders). Emulsion and foamed bitumen. Aggregate production, sampling, composition (mineralogy), physical properties. Asphalt composition for base and surfacing, thin and ultra-thin mixes, hot and cold mixes, spatial considerations and volumetrics, mix design (with examples), special mixes. Material properties

important for structural and functional design. Factors influencing the performance of seals, selection of binder, seal design and material specifications. Thin layer technology.

10848-842 (15) Pavement Materials III: Bitumen Stabilised Materials

Base bitumen binders and characteristics; Foamed bitumen characteristics; Bitumen emulsion characteristics; Emulsifiers; Aggregate selection and suitability; Marginal materials; Mix design of cold bituminous mixes; Curing; Compaction; Mix volumetrics and spatial composition; Performance of cold mix; (laboratory, APT, LTPP); Pavement Design with BSMs (CIPR); Construction issues; Slurries.

Structural Engineering

Package coordinator: Dr Tata Van Rooyen

10810-812 (15) Advanced Structural Concrete Design

This module develops students' abilities to: consider and understand material models, member stiffness and subframes; analyse and design deep beams, pile caps, foundations, surface beds, slabs, transfer systems, retaining structures, liquid retaining structures and post-tensioning; consider requirements related to earthquake design and concrete remedial works; and consider risk, reliability, disproportionate collapse and ultimate and serviceability limit state failures.

10811-812 (15) Advanced Structural Steel Design

Design of industrial and commercial steel structures to SANS 10162-2005, including the design of plate girders, crane girders and overhead travelling crane support structures subjected to fatigue loading.

10866-812 (15) Structural Dynamics

This module presents computational methods for the dynamic analysis of structures. A basic understanding of static analysis of structures is necessary. Knowledge of finite element methods is not a prerequisite but will be helpful. Students can take MT11 in one year and MT04 in the following year. Complex and Fourier analysis are introduced in the module, but a good foundation in matrix and vector algebra and mathematics in general is crucial.

Transportation Engineering

Package coordinator: Prof Marion Sinclair

10831-812 (15) Geometric Road Design

Traffic and capacity, design criteria, safety systems design, sight distance, horizontal alignment, vertical alignment, cross- section elements, roadside restraint systems, designing for automated driving, drainage, intersections, interchanges, pedestrians and cyclists.

13004-841 (15) Intelligent Transport Systems

Basic ITS elements, Systems engineering approach for ITS, Technology and communications overview, Overview of application areas including Freeway Management Systems, Public Transport Systems and Arterial Management Systems, New developments such as Connected and Autonomous Vehicles as well as Smart Cities, Big Data in Transportation overview and Applications.

10853-842 (15) Public Transport

The role of public transport in the community, system components, integration and co-ordination of different modes, technological status, liaison problems, terminal requirements, costs, effect on the environment and the economy, legislation, management, operation and control.

10875-812 (15) Traffic Flow theory

This course considers the theory of traffic movement required by traffic engineers. Traffic flow theory is the mathematical description of traffic movement, specifically considering the interaction between drivers and vehicles on a road. This provides input to the analysis of traffic state on all types of roadway infrastructure, including uninterrupted flow on roadways, and interrupted flow at intersections. In this course, students will consider the mathematical descriptions of traffic state: flow, speed and density on the macroscopic and microscopic levels.

10877-812 (15) Transportation Planning

Overview of the process, demand estimation, surveys for transportation studies, trip models: trip generation, trip distribution, modal split, trip assignment, road networks, public transport networks, public participation, land use forecasts.

10878-812 (15) Transportation Safety

This module presents the current thinking on safe road design, looking specifically at the emergence of the Safe System Approach to traffic safety and at how the principles of SSA can be applied in the South African context. It begins with an overview of the factors that undermine the safety of road users globally as well as in SA and looks at the role that traffic engineering plays as one of the constituents of the SSA - and how it relates to Safe Road Users, Safe Speeds, and Safe Vehicles. Road safety issues that are prevalent in the SA context are highlighted, Including safety issues around NMT users (and particularly pedestrians) and public transport safety. Students are exposed to the techniques of safety analyses, the identification and assessment of engineering countermeasures, and the economic and socioeconomic evaluation of road safety interventions.