

DEPARTMENT OF ELECTRICAL AND ELECTRONIC ENGINEERING

Structured MEng in Smart Grid Technology: 2022

ADMINISTRATIVE/ACADEMIC REQUIREMENTS

GENERAL:

This is a programme offered by the Dept. of E&E Eng. in response to worldwide evolutionary processes in the electrical energy domain. These are seen to be technologically very exciting, but will also have considerable impact on conventional networks, in the near to medium future.

ADMISSION:

Prerequisite: To qualify for admission to our MEng (structured) programme in Smart Grid Technology, the applicant must hold at least a BEng, a BSc Hons, another relevant four-year bachelor's degree, an MTech, or a PGDip (Eng.).

DURATION AND TEACHING LOAD:

Typically, two years on a full-time or part-time basis, although on a full-time basis the programme can potentially be completed within one year. The curriculum consists of eight one-week block modules with 40 hours of contact time and an additional 110 hours work via distance education per module. Successful completion of all modules is followed by a thesis project, which can also be done in parallel to modules dependent on time-availability. Each block carries 15 academic credits and the project 60 credits (description is provided in Appendix A).

COURSE MODULE DESCRIPTIONS

COMMON MODULES (2):

The Faculty of Engineering has identified five modules that cover aspects considered to be common to all branches of Engineering. Students must include **two** of these modules in their curricula, selected from the list below (content descriptions are provided in Appendix A).

Module Title	Code	Host Department	Credits
Advanced Topics in Engineering Management 873	11748	Industry Engineering	15
Numerical Methods 876	36323	Applied Mathematics	15
Project Management 873	51993	Industry Engineering	15
Project Economics and Finance 812	58157	Civil Engineering	15

COMPULSORY MODULES (5):

The core modules of the structured MEng in Smart Grid Technology are listed below. Students are required to complete all these **five** modules. For detailed module descriptions, please refer to <https://www.crses.sun.ac.za/coursework-masters-diploma/>.

Module Title	Code	Host Department	Credits
Smart Grid Technology Overview 874	13808	E&E Engineering	15
Power System Operations (previously Integrated Supply Side Technology 874)	t.b.c.	E&E Engineering	15
Smart Grid Communications 874	13807	E&E Engineering	15
Distribution Customer Concepts (previously Integrated Demand Side Technology 874)	t.b.c.	E&E Engineering	15
Power System Data Analytics	t.b.c.	Industrial Engineering	15

ELECTIVE MODULES (1):

In addition, students are also required to select **one** additional elective module from the list below:

Module Title	Code	Host Department	Credits
Advanced PV Systems 844	13364	E&E Engineering	15
Energy Storage Systems 874	13810	E&E Engineering	15
Wind Energy 844	13185	M&M Engineering	15
Long-term Power System Planning	t.b.c.	E&E Engineering	15

Students may apply to the Postgraduate Coordinator for recognition of modules done at other departments or institutions. However, no recognition can be granted for modules done as part of another qualification. Note that for modules presented at other institutions, students interested taking these modules will need to register for it themselves at the relevant institution, and then present the credits obtained to Stellenbosch University for recognition.

APPENDIX A: MODULE DESCRIPTIONS:

ADVANCED TOPICS IN ENGINEERING MANAGEMENT (11748 – 873)

Host: Department of Industrial Engineering

The purpose of the module is to present principles of general management within the context of technical disciplines. The course 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 course 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 will include a specific focus on human resource management, both 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. We contextualise the above under the theme of “leadership”, with an exploration of different leadership styles, communication, and motivation.

NUMERICAL METHODS (36323 – 876)

Host: Division of Applied Mathematics, Department of Mathematical Sciences, 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.

PROJECT MANAGEMENT (51993 – 873)

Host: Department of Industrial Engineering

The module focuses on advanced topics in project management, and it is expected that participants have either attended a project management course 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.

PROJECT ECONOMICS & FINANCE (58157 – 812)

Host: Department of 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. Several case studies will be covered in the module, including projects to construct a bridge, a satellite, and a wind turbine farm. Current module content:

- Infrastructure and development finance: Sources of business finance and private sector project financing models.
- Review of time value of money/discounted cash flow/interest calculations.
- Basic accounting statements (balance sheet, income, and cash flow statements).
- Costing and management accounting – theory/techniques and costing system concepts.
- Ratio analysis, from basic ratios to the DuPont approach.
- Economic analysis of investment decisions.
- Market valuation (EVA and MVA).
- Value drivers in the company, sustainability, and the Balanced Scorecard.
- The national accounts and economic growth.
- Feasibility studies and techno economic analysis.
- System identification, parameter identification, environment, and system boundary.
- Definition, environmental scanning, system modelling and simulation concepts, modelling.
- Risk and uncertainty in infrastructure finance and project development.
- Materials, labour, and equipment: Impact of required service and quality levels. Cost estimation and cost controls of construction projects.
- Revenue stream estimating and modelling. Financing models.

PROJECT 884

Prerequisite:

Admission to the MEng (Structured) in Electrical & Electronic Engineering and completion of all the other required modules in the program.

Total credits of module: 60

Content:

A project that entails formulating objectives, planning the project, surveying the relevant literature, and applying what was learned in the modules, as well as from the literature review and own research to an electrical engineering research project. Critical evaluation of the research results will also be required.

The project is individually supervised.