DE MONTFORT UNIVERSITY DUBAI

Energy and Sustainable Development MSc module details

Engineering Business Environment and Research Methods

The engineering business part of this module is to enable students to understand and reflect upon the role of business in a rapidly changing, globalised world. It identifies opportunities and threats for industry arising from environmental policy, legislation and societal change, and explores how businesses respond to future environmental challenges: for example, through supply chain management, logistics, life -cycle analysis, green accounting and carbon trading. Challenging questions are asked such as: can industry be a positive force for good? How do businesses learn and adapt to new challenges and economic models? This module benefits practitioners in industry, and future academics exploring the sustainability of engineering businesses.

The module also teaches students self-direction, and originality in problem solving. The research methods and associated study skills parts of the module provide students with the skills to successfully complete a research project.

Teaching of Research Methods (RM) will be integrated with the sustainable engineering part, through coursework and assignments. RM Material includes: understanding the research of others, literature reviewing, research methodologies, data interpretation and analysis, research ethics, intellectual property and report writing. A central aim is to prepare students for their dissertation or research project with the assignments related to planning a research project.

Data Analytics for Sustainable Energy Systems

As energy systems become smarter, their data footprint increases drastically. It is imperative to be able to manage these large datasets, for the sustainability of the global energy system. Data management, as used here, includes data acquisition, cleaning, manipulation, processing, and storage. This module teaches students the key concepts of data analytics and its application to energy system design and operation. It starts with a revision of the fundamentals of scientific programming in Python, to provide students with the requisite skills for advanced topics later in the module. The Python programming language has been chosen by virtue of its popularity in industry and its plethora of open-source Data Science libraries. Students are further introduced to Statistics, Machine Learning, and Optimisation to equip them with the skills required for solving moderately advanced problems in, but not limited to, uncertainty analysis; supervised and unsupervised machine learning; reinforcement learning; mixed-integer linear programming; model-predictive control; operation management; and decision making under uncertainty.

The second part of the module applies the concepts studied in the first part to carefully selected real-world case studies from all stages of the energy value chain. Case studies could be drawn from: demand forecasting in multi-vector energy systems, renewable energy generation prediction, electric vehicle charge scheduling, model-predictive control of distributed energy systems, outage management in electricity grids, load management, energy theft detection, economic dispatch of power systems, consumer profiling, and energy market analysis.

Resource Efficient Design and Manufacture

The aim of this module is to provide students with an understanding of resource efficient design in both industrial and non-industrial contexts. Design will be seen to relate to both product and process, while resource efficiency will be interpreted as the ability to 'design out' waste and 'design in' the efficient use of natural resources. Industrial systems will be viewed as a subset of the examined processes. The module will introduce students to a whole systems perspective to the design process as well as energy management techniques and circular economy principles applicable to manufacturing. It will encourage students to analyse each stage of the life cycle of products or processes in terms of their impacts on resource use and how these impacts can be identified and mitigated.

Discussions will consider the roles of designers, manufacturers, and users in addressing the challenge of moving towards more sustainable consumption and production. A number of different approaches to designing more resource and energy efficient products, processes, services and systems will be explored, and students will have the opportunity to assess the strengths and weaknesses of these different approaches across various design and industrial systems contexts. Through practical activities, and the use of case studies, students will develop the skills and expertise necessary, at each stage of the design process, to effectively facilitate and manage resource efficient design and sustainable manufacturing.

Sustainable Energy and Transport

This module comprises two parts. The first part introduces students to the principles of sustainability in energy systems and the role of sustainable energy systems in the realisation of the United Nations Sustainable Development Goals. It further looks at the various energy technologies and examines their global prospects, as well as environmental and cost implications. Furthermore, it covers renewable energy systems in detail and introduces students to their techno-economic analysis using industry-recognised software. Other topics covered in this part of the module include energy economics; heating and cooling; energy storage; flexibility; energy policy and regulation; and energy access and reliability improvement in low-income economies.

The second part of this module introduces students to low-carbon transport technologies, their characteristics, as well as applications. Building on the knowledge gained from the first part, it assesses the energy supply chains that are essential to the sustainability of these technologies. It further explores the operational factors of sustainable transport technologies together with their integration with smart cities and grids. Other issues addressed include behavioural, social, financial, environmental, and political issues within the context of a sustainable low-carbon economy. This part also looks at mobility service delivery and new business models, as well as the socio-economic and policy aspects of sustainable transport and market development.

Sustainable Development in Practice

This module aims to equip students to develop the core competencies to address sustainable development challenges in their future working lives and as actively engaged citizens. This is done through active engagement with a range of contemporary sustainable development challenges, linked to the United Nations Sustainable Development Goals. Case studies of real-world local and international issues and interventions to promote sustainable development are explored, drawing on linkages to contemporary DMU research projects and community engagement.
The module draws upon theories of social and organisational change and applied psychology as its theoretical basis, alongside practitioner-developed understandings of behaviour change design, effective governance and social transformation. The knowledge and skills developed are intended to be applicable in a range of settings, including organisations, government, communities and the personal sphere. An important emphasis in this module is on students' development as effective and reflective practitioners. This is embedded through a highly participatory delivery style, the chance to implement and learn from real-life behaviour change interventions and through authentic assessments that reflect the real-life activities that sustainability professionals engage in.

Individual Project

This module merges two previously distinct modules, Dissertation (for non-engineering courses) and Individual Project (for engineering courses). As it will cover a great diversity of courses, it will be delivered as a team effort.

The module aims to introduce the student to the discipline of independent research carried out in a restricted timeframe. It will involve self-organisation, application, analysis and presentation of work. The topic will be chosen from a list provided by staff, grouped by discipline, or chosen by the student and agreed with the dissertation supervisor. It must be relevant to the course being taken. The project may involve practical work, or be entirely desktop based. An ethics form will be required with approval but is not marked. The Report should be approximately 10,000 – 15,000 words, reflecting the amount of practical work and the nature of the topic.