ELE2212 ELECTRICAL ENERGY SYSTEMS

Hours per Semester				Weighted Total Mark	Weighted Exam Mark	Weighted Continuous Assessment Mark	Credit Units
LH	PH	TH	CH	WTM	WEM	WCM	CU
45	0	00	45	100	60	40	3

Rationale

The course discusses the different energy sources available in today's society and well their relative merit, demerits and usage implications.

Course Objectives

The course is designed to equip students with a broad training in, and understanding of, energy production, delivery, consumption, efficiency, economics, policy and regulation, considered in the context of the sustainability of energy supply and consumption patterns, both locally and globally. A unique feature of the course is its broad approach to the development of sustainable routes to the generation and supply of energy within which renewable energy is a key theme.

Detailed Course Content:

Energy sources of the current world: sources, conversion and generation principles, challenges of the current energy mix

Technologies for Sustainable Energy: **[15 Hours]**

- Principles of operation of sustainable energy conversion by (i) wind; (ii) wave; (iii) tidal; (iv) solar; (v) biomass; (vi) geothermal; (vii) combined heat and power systems;
- Principal aspects of engineering design underpinning these technologies;
- constraints on each technology, both imposed by physical fundamentals, and by current levels of technology and market, supported by quantitative evidence where possible;
- Fundamentals of grid connection of distributed generators and the problems and constraints associated with this;

Energy Efficiency, Resource and Environment: **[15 Hours]**

- Availability of natural resources and the implications of finite fossil resources;
- The concept of proved reserves and R/P ratios;
- Techniques for energy efficiency in buildings, including passive solar design
- Relationships between energy use and climate change.

Power Systems Engineering and Economics: **[15 Hours]**

- Iterative methods of solution to non-linear nodal network analysis and use a load flow package;
- Effects of AC network on transmission and distribution of electricity
- Principles of power system economics and how market-based solutions can be applied to a previously centrally-controlled industry
- Effects of network on marginal prices at different locations
- Taking human reactions into account when designing engineering solutions

Mode of Delivery

The course will be taught by using lectures, tutorials and assignments.

Assessment

Assignments, tests and final examination. Their relative contributions to the final grade are :

Requirement	**Percentage contribution**
Course work (Assignments, tests)	40%
Final examination	60%

Total	**100%**

Method of Teaching /Delivery

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Total	**100%**

Recommended and Reference Books

[1] Peter Gevorkian. *Sustainable Energy Systems Engineering*. - McGraw-Hill (2007) - ISBN 0071473599

[2] Wissenschaftlicher Beirat der Bundesregierung Globale Umweltveränderungen (Germany. *World in Transition: Towards Sustainable Energy Systems.)* - Earthscan (2004)- ISBN 1853838020

[3] Naim Hamdia Afgan, Naim Afgan, Maria da Graca*. CarvalhoSustainable Assessment Method for Energy Systems: Indicators, Criteria, and Decision Making Procedure.* Kluwer Academic (2000)
- ISBN 0792378768