The University Of Sheffield.

Electronic & Electrical Engineering.

EEE163 SYSTEM DESIGN ANALYSIS

Credits: 10

Course Description including Aims

The unit aims to give students an appreciation of the decisions that need to be taken during the design of an electrical or electronic product. Through guided deconstruction of commercially available products the students will see how systems are formed and how components interact within a system. The necessary characteristics of materials and assembly will be discussed to enable an appreciation to be gained as to how things work and are how they are assembled to form working products.

Outline Syllabus

This unit aims to investigate the design and assembly of common electrical and electronic devices. Examples of commercially available devices will be examined in detail and deconstructed to allow critical assessment of the assembly and the design decisions that have been made in their construction. The unit will be a combination of formal lectures and laboratory analysis of the devices, being assessed by a short report and interaction during laboratory sessions. A formal group talk will also form part of the assessment.

Time Allocation

Formal contact: lectures - 6 hours; seminars – 2 hours; laboratory sessions supported by demonstrators – 18 hours. Self-directed study following each lab class – 12 hours. Report writing – 6 hours. Talk preparation – 8 hours.

Recommended Previous Knowledge

Entry qualifications.

Assessment

Examination of lab book after each lab session; one written report and one group presentation. There is no formal examination.

Recommended Books

Ashby MF, Shercliff H and Cebon D	Materials: engineering, science, process and design	Oxford 2009
Tummala R	Fundamentals of Microsystem Packaging (electronic resource)	McGraw Hill 2001

Objectives

By the end of the module a successful student will be able to:
1) Appreciate how products are designed and assembled.
2) Demonstrate rudimentary skills in critical assessment.
3) Determine suitable characteristics for the materials used in the construction of a product.
4) Present their ideas orally.

Detailed Syllabus

The lectures, seminars and practical classes will cover the basics of the following:

Function	What do electrical/electronic products do?
Method	How do they operate?
Inputs/outputs	What goes-in / comes-out of product?
Parts list	Shopping list of sub-components
Raw Materials	What are they made of?
Manufacture	How is it made? Identify design issues?
Power	Mains? Battery? AC? DC?
Working environment	Moisture? Temperature?, etc…
End of life	Materials recovery? Landfill? Re-use?
Safety	Electric shock risk? Fail-safe?
Cost	Single use? High reliability?

UK-SPEC/IET Learning Outcomes

By the end of the course the students will be able to: 1) appreciate how products are designed and assembled, 2) demonstrate rudimentary skills in critical assessment, 3) determine suitable characteristics for the materials used in the construction of a product and 4) present their ideas orally.

All of the outcomes will be introduced in lectures and seminars and then explored in lab classes, where the students will disassemble and analyze various electronic/electrical systems (e.g. toaster, electric screwdriver, CD drive, hard drive, compact fluorescent light bulb, etc.).

Outcome Code	Supporting Statement
SM1p/SM1m	The basics of an electronic system will be firmly established. Namely electrical conductors linking electronic/electrical components and shielded by electrical insulators.
SM3p/SM3m	The electronic/electrical systems that are investigated may relay on physical/ chemical/mechanical phenomena normally considered outside the scope of an electronics degree. An appreciation of how these different phenomena can be integrated will be given.
EA1p	Introductory appreciation of circuit, motor and power supply design will be given.
EA1m	Students will learn key fabrication principles by hands-on investigations.
EA2p/EA2m	Appreciation of system design will be obtained, together with an overview of end-of-product-life options (disposal/re-use/recycling).

D2p/ D2m	The students will be introduced to health and safety restrictions relating to manufacture, use and disposal of electronic products. The energy implications of different manufacturing processes will be discussed.
D1p/ D1m	The ergonomics and aesthetics of product design will be considered.
D5p/ D5m	The cost implications of material and manufacturing choices will be explored.
D4i	The students will be encouraged to suggest improvements to the products that they investigate and to consider alternative strategies.
D4p/ D4m	Production, operation and disposal methods will be discussed.
D6i / D6p	The module includes the preparation and delivery of a group presentation to their peers and academic staff.
ET2p/ ET2m	The price of raw materials and processing/assembly will be introduced. Operating and disposal costs will also be examined.
ET4p/ ET4m	The UK electronic waste management directive (WEEE) will be explained. As an example, the strategy adopted by University of Sheffield will be described.
ET5p / ET5m	Students learn about WEEE and RoHS legislation.
ET6p/ET6m	Prior to each lab, the students perform risk assessment. They also learn about environmental issues related to electronics fabrication.
EP2p/ EP2m	The relevant (electrical, mechanical, thermal, optical, magnetic) properties of the engineering materials will be established.
EP3p/ EP3m	The module includes a large number of lab classes in which the students will be encouraged to disassemble various electrical systems. This will include manual disassembly and hand de-soldering. They will perform simple electrical measurements and tests on electrical sub-systems.
EP4p/ EP4m	The students will be encouraged to access component data sheets.
EP8p/ EP8m	By its nature, the students will not have sufficient time/resource to fully characterize the systems that they are investigating; hence they will have to consider technical uncertainty in their findings.