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| **Unit Title** | Engineering Design and Sustainability |
| **Level** | 5 |
| **Reference No.**  ***(showing level)*** | EEC\_5\_977 |
| **Credit Value** | 30 |
| **Student Study Hours** | Contact hours: 96  Student-managed learning hours: 204 |
| **Pre-requisite learning** | Pass all Level 4 units |
| **Co-requisites** | None |
| **Excluded combinations** | None |
| **Unit co-ordinator** | Esther Perea |
| **Faculty/Department** | ESBE / Engineering & Design |
| **Short Description** | The first half of this unit is designed to extend the student's understanding and ability to appropriately select and then apply a range of design methodologies, and computer aided design tools and techniques to the solution of engineering design problems.  A wide range of problem solving techniques will be introduced to reinforce the need for a structured approach to engineering design. A range of “hands-on" experience is offered to the student including further 2D work together with a strong emphasis on 3D parametric modelling and the associated tools widely used in industry.  The second half of the unit This unit covers practical aspects of mechanical engineering design including project management, manufacturing technology, safety factors, sustainability and reliability.  The unit involves multi-disciplinary project work. It includes individual and group-based elements. |
| **Aims** | The design aspects of this unit aim to develop the student's ability to conceive optimal design solutions to engineering problems using established design theory, while working within the practical constraints imposed by the materials and manufacturing processes available to him/her. They also aim to enhance the student's appreciation of customer and user needs and the importance of considerations such as aesthetics.  The Computer Aided Design element of the unit aims to develop the ability to appropriately select, and then apply, a range of computer aided design tools and techniques to the solution of engineering design problems.  The manufacturing technology component of this unit aims to extend the student's knowledge and understanding of the engineering workshop and laboratory skills required in engineering design and manufacture. It also develops the student's ability to work in a team and to appreciate the importance of co-ordinated teamwork and project management.  An overall aim of the unit is to develop in the student an appreciation of the social, environmental, ethical, economic and commercial considerations affecting the exercise of their engineering judgment. |
| **Learning Outcomes** | **Knowledge and Understanding**  Upon successful completion of this unit students will be able to:   1. Understand the design process and be able to evaluate the outcomes. 2. Analyse an open-ended problem, present a range of detailed proposals and then develop viable solutions 3. Evaluate their design ideas by self-selecting then adapting schemes based on a range of established design methodologies 4. Use parametric modelling systems to produce 3D CAD models, design communication and manufacturing data 5. Understand the framework and wider issues relating to sustainable development   **Transferable Skills**  *-* Communications skills  *-* Use of information technology  *-* Be an effective member of any project team.  *-* Ability in critical analysis  - Project management and the role of the engineering designer in society.  **Practical Skills**  - Building and testing a system once it has been designed |
| **Employability** |  |
| **Teaching and learning pattern** | Teaching will consist of an integrated program of lectures and hands-on experience. Supported by seminars, demonstrations, audio-visual aids, case studies and documentation. Student-centred assignments will provide the principal vehicle for teaching.  For the most part, the unit consists of workshop and laboratory based project work.  The unit will also include formal lectures covering general mechanical engineering design and the theoretical, technological and sustainability issues appropriate to the actual projects undertaken.  Guest lecturers from industry will be encouraged. |
| **Indicative content** | *Design Theory*:  The Engineering Design process. Problem definition. Product Design Specifications. Concept Generation. Design evaluation tools. Detailed design. Design Management. Design process improvement. Integration of style and technology. New Product Development. Team integration and management. Understanding user behaviour.  *CAD Modelling*:  - *2D drafting*: Concept sketches, Drawing Standards.  Overview of designated CAD modelling system for drafting.  - *3D CAD Modelling*: 2D sketching and constraints, 3D features, History based modification, reference geometry, Surface modelling, Data management, Assemblies, Data exchange.  - *CAD Management*: Modelling Strategies, Classification of CAD hardware and software, Rapid prototyping technologies, Presentation and communication.  - Design methodologies. Product Design Specification.  *-* Design for sustainability; recycled materials, Life Cycle Analysis  *-* Design case studies, e.g., solar powered vehicles, wind turbine technology.  *-* Communication and presentation techniques.  *-* Economic theory and legal aspects relating to commercial engineering design and manufacturing practice  *-* Design project management; meetings, chairing, taking/writing minutes, planning, human interactions  *-* Prototyping, testing and evaluation |
| **Assessment**  ***Elements & weightings*** | Assessment 1: Design methodology and application of CAD tools.  Assignment 2: Design, make and test a system  Assignment 3: time constrained test (2 hours) covering aspects of sustainability  (Weightings 100% Coursework) |
| **Indicative Sources**  ***(Reading lists)*** | TBC |