## Engineering Design & Product Development

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| **Unit Title** | **Engineering Design & Product Development** |
| **Level** | Five |
| **Reference No.** | EEC\_5\_426 |
| **Credit Value** | 30 CAT points |
| **Student Study Hours** | Contact hours 104 hours  Student managed learning hours 196 hours |
| **Pre-requisite learning** | Engineering Workshop Theory and Practice (Level Four) |
| **Co-requisites** | None |
| **Excluded combinations** | None |
| **Unit co-ordinator** | Anthony Roberts |
| **Faculty/Division** | Engineering Science and the Built Environment/ Department of Engineering and Design |
| **Short Description** | This unit is intended to extend the student’s understanding and ability of engineering design, enabling them to appropriately select and then apply established design theory alongside product development and prototyping techniques to effect comprehensive solutions to engineering problems. |
| **Aims** | This unit aims to extend the students understanding and ability in the following areas:   * The use of established design theory to solve engineering problems. * The use of computers in engineering design, and manufacturing. * Communication of design ideas through specifications, concept sketches and visual presentations. * Prototyping and development of physical models to demonstrate effectiveness of design ideas. |
| **Learning Outcomes** | At the end of this unit students will be able to:   * Analyse an open-ended problem, present a range of detailed proposals and subsequently develop viable solutions. * Evaluate their design ideas by self-selecting then adapting schemes based on a range of established design methodologies. * Understand the relationship between design and manufacture. * Use a range of computing tools to communicate design ideas, produce 3D development models for virtual testing and output to direct manufacturing. * Manufacture a product from specifications, design data and tolerances. * Appropriately select materials to optimise specified design requirements. * Devise and carry out test procedures to measure the success or otherwise of the design. |
| **Transferable Skills** | * Communication through different types of drawing, discussion, written reports and presentations of engineering and design data. * Numeracy in the manipulation of quantitative data * Understanding methodologies for design and manufacture * Able to apply critical analysis to the evaluation of design solutions |
| **Teaching and learning pattern** | The unit will be delivered over two semesters with material being split into three blocks of core material that will be delivered through a combination of keynote lectures, practical computing workshops. The hands-on tutor led sessions in the engineering and prototyping workshops will provide ample opportunity for students to produce physical prototypes in line with the issued assignments.  The designated four hours of contact time would typically be broken down as indicated:  Semester One  120 minutes – Keynote Lectures/seminars - key theory  120 minutes – Seminars/computing sessions – CAD  Semester Two  240 minutes – Product development, Seminars/demonstrations and prototyping in the engineering workshops. |
| **Indicative content** | **Design Theory**  The Engineering Design process. Problem definition. Understanding user behaviour. Product Design Specifications. Research and investigation. Concept Generation. Design evaluation tools. Detailed design. Design Management. Design process improvement. Integration of style and technology. New Product Development. Team integration and management.  **Engineering Design Communication**  Review of orthographic drawing and associated drawing Standards. 2D sketching and constraints, feature based modelling. Modelling Strategies. History vs. Direct modelling. Surface modelling. Product data management. CAD Assemblies. Design for manufacture. CAD based evaluation and testing. Classification of CAD hardware and software, Link to rapid prototyping technologies. Presentation and communication of data.  **Materials For Product Development**  Metals, polymers and other materials: classifications, properties and performance for design. Selection of materials for strength, deflection, fatigue, thermal environments. Corrosion mechanisms: factors and prevention methods. Material finishing processes: decorative and functional finishes.  Structural behaviour of materials: analysis and design of load carrying elements: stress systems: design of load-carrying joints: shear, torsion: use of computer analysis techniques: behaviour of adhesive joints under load.  **Product Development - Prototyping**  Prototype and model production. Input from research and investigation. Decision making in product development. Design Scheduling. Evaluation and testing. Relationship between form and production processes. Prototyping methods. Modelling methods.  Product finishing. |
| **Assessment**  **Elements & weightings** | This unit is assessed by 100% coursework. This comprises two equally weighted assignments.  Assignment one - Integrates design theory with use of computing technology.  Assignment two - Provides students with the opportunity to assimilate the taught material through the design, development and manufacture of a prototype in fulfilment of an open ended design problem.  For each assignment assessment are carried out as a staged process to enable close monitoring of student progress. Students must attain an overall mark of 40% to pass this unit. |
| **Indicative Sources**  ***(Reading lists)*** | Core Texts:  Pugh S, Total design: Integrated Methods for Successful Product Engineering, Addison Wesley, ISBN 0-201-41639-5, 1997    Ulrich K, Steven Eppinger S, [Product Design and Development](http://www.amazon.com/exec/obidos/tg/detail/-/0072471468/qid=1114096839/sr=1-4/ref=sr_1_4/002-9757547-8573633?v=glance&s=books) McGraw-Hill International, ISBN 978-0071259477, 2007  Lidwell W, Universal Principles of Design,Rockport Publishers, ISBN 978-1592530076, 2007  Background Texts:  Lockhart S D & Johnson C M, Engineering Design Communication, Prentice Hall, ISBN 0-201-33151-9, 2000  J, [Vogel](http://www.amazon.com/exec/obidos/search-handle-url/index=books&field-author=Craig%20M.%20Vogel/002-9757547-8573633) C, Creating Breakthrough Products: Innovation from Product Planning to Program Approval, Prentice Hall, ISBN 978-0132618625, 2002  Ashby M, Johnson K, Materials and Design: The Art and Science of Material Selection in Product Design, Butterworth-Heinemann, ISBN 978-1856174978, 2002 |