SUBJECT OUTLINE: EN211 COMPUTER AIDED DESIGN

Programs	All Engineering (NQF Level 8)
Subject Name	Computer Aided Design
Subject Code	EN211
Duration	13 Lecture Weeks, 1 Exam Week, 1 Mid-Semester Week
Contact Hours	6 Hours/Week
Credit Points	18
Delivery Mode	On campus
Prerequisites	EN114 Engineering Computation
	EN124 Introduction to Engineering Design
Corequisites	Nil
Subject Coordinator	TBA

Synopsis

The subject introduces students to the modern approach of 3D Computer Aided Design for generating and analysing solid models and assemblies related to Civil, Electrical, Mechanical and Mining Engineering systems and structures. The included topics address theoretical and practical aspects encountered in the creation, modification, analysis, and optimization of engineering design. Also included are topics dealing with the creation of technical drawings, generation of bills of materials and basic elements of static, dynamic and thermal analysis.

Subject Topics

1. **Characteristics of Digital Engineering Documentation**: Characteristics of feature-based, parametric solid modeler. Principal components of modern 3D CAD software user interfaces. Relationships between digitally created sketches, components, assemblies and technical drawings.

2. **Creation of Fully Defined Sketches**: Characteristics of sketch geometry and relationships between geometrical features. Sketch tools. State of the sketch and the creation of fully defined sketches. Design intents function of dimensioning methodologies.

3. **Basic 3D Component Modelling**: Extrusions from sketches. Boss and cut extrusions. Hole wizard, fillets, basic drawings, dimension changes. Associativity between solid models and drawings. Feature parameter editing.

4. **Advanced 3D Component Modelling**: Revolved and sweep features. Shellings and ribs. Patterns. Part configurations, repairs and design changes. Design tables, equations, families of parts. Selection of materials and calculation of physical properties of solid models: mass, center of gravity, moment of inertia. 3D printing.

5. **Creation of Assemblies**: Bottom-up and top-down assemblies. Import of commercial parts. Geometrical, mechanical and advanced mating relationships

between parts in assembly. Mass properties and interferences. Creation of exploded views. Bills of materials.

6. **Creation of Technical Drawings for 3D Parts and 3D Assembly Models**: Templates, views, dimensions and tolerances. Sections and technical notes.

Subject Learning Outcomes SLOs

On completion of this subject, students will be able to:

1. Describe the characteristics and requirements of digitally created engineering documentation and the relationships between sketches, parts, assemblies and technical drawings for engineering design.
2. Create fully defined design sketches
3. Execute basic 3D component modelling and understand design intend and associativity between 3D models and technical drawings.
4. Undertake advanced 3D component modelling, implement design changes, assign materials to models and calculate physical properties of models. Use design tables and equations and create families of parts.
5. Create 3D assemblies, add mating relationships between parts, evaluate mass properties and implement changes for interference avoidance. Create exploded views and bills of materials for application in engineering design.
6. Create technical design drawings for parts and assemblies. Add dimensions, tolerances, technical notes, sections and isometric views to created drawings. Prepare parts for 3D printing and 3D print them.

Assessment Tasks and Weightings: 100% Continuous

To obtain a pass grade in this subject 50% overall must be achieved. There is no final examination for this subject.

Students must also refer to the Subject Assessment Details.

Assessment 1 - Test: Individual computer-based test on Fully Defined Sketch Creation. This test contributes 15% towards the final grade of this subject.

Assessment 2 - Test: Individual computer-based test on 3D Component Modelling. This test contributes 15% towards the final grade of this subject.

Assessment 3 - Assignment: Creation of a 3D Assembly with related Technical Drawings. This assignment contributes 30% towards the final grade of this subject.

Assessment 4 - Assignment: Creation of full Technical Documentation consisting of 3D Modelled Parts, 3D Assembly with Created and Imported Parts, Exploded Views, Bill of Materials and Technical Drawings. This assignment contributes 40% towards the final grade of this subject.

It is important that all students familiarize themselves with the University of Technology assessment guidelines including those on plagiarism. See the web site of the University of Technology at http://asix.unitech.ac.pg/apps/pnguot/?q=unitech/policies.

It is also important to note that any software or hardware related damage to the computers or other laboratory facilities attracts severe disciplinary measures.

Subject Mapping

Subject Learning Outcomes (SLO) are mapped to each of the PNG National Qualifications Framework (NQF), Course Learning Outcomes (CLO), Unitech Graduate Attributes (GA), Assessment Tasks (AT) and Engineers Australia (EA) Stage 1 Competencies.

SLO	SLO to NQF	SLO to CLO	SLO to GA	SLO to AT	SLO to EA Stage 1 Competencies
1	Applications, Knowledge and Skills	2	Critical Thinker, Technology Savvy	1, 2, 3, 4	1.2, 1.5, 2.3
2	Applications, Knowledge and Skills	2	Critical Thinker, Technology Savvy	1	1.2, 1.5, 2.1, 2.2, 2.3
3	Applications, Knowledge and Skills	2, 7	Critical Thinker, Technology Savvy	2, 3	1.2, 1.5, 2.1, 2.2, 2.3,
4	Applications, Knowledge and Skills	2, 6, 7	Critical Thinker, Technology Savvy	2, 3, 4	1.2, 1.5, 2.1, 2.2, 2.3, 2.4, 3.4
5	Applications, Knowledge and Skills	2, 6, 7	Critical Thinker, Technology Savvy	3, 4	1.2, 1.5, 2.1, 2.2, 2.3, 2.4, 3.4
6	Applications, Knowledge and Skills	2,3,4,6, 7, 8, 9	Critical Thinker, Technology Savvy, Effective Communicator	1, 2, 3, 4	1.2, 1.4, 1.5, 2.1, 2.2, 2.3, 2.4, 3.4

Engineers Australia Stage 1 Competencies

1. Knowledge and Skills Base	2.Engineering Application Ability	3. Professional and Personal Attributes
1.1 Comprehensive, theory based understanding of the underpinning natural and physical sciences and the engineering fundamentals applicable to the engineering discipline.	2.1 Application of established engineering methods to complex engineering problem solving.	3.1 Ethical conduct and professional accountability.
1.2 Conceptual understanding of the mathematics, numerical analysis, statistics, and computer and information sciences which underpin the engineering discipline.	2.2 Fluent application of engineering techniques, tools and resources.	3.2 Effective oral and written communicator in professional and lay domains.
1.3 In-depth understanding of specialist bodies of knowledge within the engineering discipline.	2.3 Application of systematic engineering synthesis and design processes.	3.3 Creative, innovative and pro-active demeanour.

1.4 Discernment of knowledge development and research directions within the engineering discipline.	2.4 Application of systematic approaches to the conduct and management of engineering projects.	3.4 Professional use and management of information.
1.5 Knowledge of engineering design practice and contextual factors impacting the engineering discipline.		3.5 Orderly management of self and professional conduct.
1.6 Understanding of the scope, principles, norms, accountabilities and bounds of sustainable engineering practice in the specific discipline		3.6 Effective team membership and team leadership.

Unitech Graduate Attributes

Attribute	Academic Dimension	Personal Dimension	Transferable Dimension
1. Lifelong Learner	Sustained Intellectual Curiosity and Use of Feedback Reflected in Work	Sets Aspiration Goals for Personal Improvement and Career Growth	Takes responsibility for one's learning and development.
2. Critical Thinker	Use of Inference Rules in Analysing and Finding Solutions for Complex Problems	Non-Emotional, Logic and Critical Thinking Abilities in all Situations.	Ability to find solutions to problems by using logical and imaginative thinking.
3. Effective Communicator	Abilities in Articulate Discussions	Skills in Delivering high Quality written essays and oral presentations.	Ability to communicate and negotiate with others and to listen to them.
4. Cultural Modernist	Familiarity with international standards, world cultures and human rights.	Tolerance of the religions and cultures of others.	Ability to work in a multicultural setting and comprehension and tolerance of religious and cultural differences.
5. Moral	Understand and	Character of	Professional behaviour

Uprightness	act upon the ethical responsibilities of their actions.	acting in a morally upright way in all situations.	at all times.
6. Technologically Savvy	Familiarity and use of technologies appropriately.	Keeping up to date with innovations.	Character of accepting new technology and quickly adapting to it.

Graduate Statement

The mechanical engineering graduate will have the skills and ability to systematically apply the engineering knowledge in an ethical and morally responsible manner in providing practical and sustainable solutions to engineering problems while upholding a level of sensitivity to social, cultural, legal and environmental issues in society.

Mechanical Engineering Course Learning Outcome CLO

Course Learning Outcomes	Engineers Australia Stage 1 Competencies
1. Possession of a deep understanding of the sciences, math, information systems and engineering fundamentals that underpin the mechanical engineering discipline.	1.1, 1.2
2. An in-depth understanding of the body of knowledge that forms the mechanical engineering discipline.	1.2, 1.3
3. Collection, synthesis and application of information within the mechanical and related engineering disciplines.	1.4, 1.5, 2.1, 2.3, 2.4, 3.4
4. Undertaking research, analysis & evaluation of ideas and concepts within mechanical engineering.	1.3, 1.4, 1.6, 2.1, 2.3, 2.4, 3.2, 3.4
5. Applying problem solving skills to complex mechanical engineering systems and processes.	1.1, 1.2, 1.3, 1.4, 1.5, 2.1, 2.2, 2.3
6. Undertake mechanical engineering design and manage engineering projects.	1.6, 2.2, 2.4, 3.1, 3.2,3.3, 3.4, 3.5, 3.6
7. Communication via multiple media to diverse audiences, undertaking team	

roles, teamwork and providing team leadership.	2.4, 3.2, 3.3, 3.4, 3.5, 3.6
8. Behaving in an ethical and professional manner and respecting others.	1.6, 2.4, 3.1, 3.4, 3.5, 3.6
9. Being cognisant of the importance of sustainability and the environmental impact of engineering.	1.5, 1.6, 3.1, 3.3, 3.4

Student Workload

The total subject workload for the average student is a nominal 150 hours, based on a 15 week semester with of lecturing and laboratories, one mid-semester week and one examination week as per PNG National Qualification Framework.

Subject Textbook

- 3D CAD in SolidWorks – Tutorials

References

- Dassault Systems – *SolidWorks Fundamentals*, Concord, Massachusetts, United States, 2012

Readings and Resources

- Leondes, C. - *Systems Techniques and Computational Methods*, CRC Press, Boca Raton, 2001

Relevant Unitech Policies

- It is important that all students familiarise themselves with the PNGUOT Assessment Guidelines including those on plagiarism and other relevant policies. These policies are available at the PNGUOT website: http://asix.unitech.ac.pg/apps/pnguot/?q=unitech/policies