Subject Description Form

Subject Code	ME42005
Subject Title	CAD/CAE Technologies for Product Development
Credit Value	3
Level	4
Pre-requisite/ Co-requisite/ Exclusion	Pre-requisite: AMA2111 Mathematics I Exclusion: ME42008 Computer-Aided Technology for Design
Objectives	To provide students with computer-aided design (CAD) and computer-aided engineering (CAE) technologies and the ability in using CAD and CAE software for product design and development.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. Use CAD and CAE technologies to support product design activities, including geometry modeling, design solution modeling, analysis and evaluation, in different design process of the whole product design and development cycle. b. Understand data exchange standards and practices between CAD and CAE models and systems and their interoperability and associativity. c. Use CAD and CAE commercial software systems for product design and development in terms of geometry modeling, kinetics simulation, design solution analysis and evaluation. d. Optimize design solutions with the aid of CAD and CAE technologies.
Subject Synopsis/ Indicative Syllabus	***Computer-aided Design*** - Geometric Models of Products • Wireframe model • Surface model • Solid Model - Geometry modeling technologies • Curve Modeling • Surface Modeling • Solid Modeling - Product kinetics modeling and simulation ***Design Analysis and Evaluation*** - Finite Element Modeling and Analysis • Basic concept of finite element method • Modeling techniques • Mesh types • Boundary constraints • Material and Properties • Symmetry in modeling and analysis - Mechanical and thermal stress analyses - Dynamic response - Product optimization in terms of product size, shape and material - Non-linear stress analysis

CAD/CAE Integration

- Data exchange standards: STL, STEP and IGES
- Interoperability and associativity between CAD and CAE
- Model defect and repairing

Case Studies

- CAD case studies
- CAE case studies
- CAD and CAE integration

Teaching/Learning Methodology

Lectures will be given to explain the theories behind CAD and CAE and their applications. (Outcomes b, c and d)

Tutorials will be used to teach the students on how to conduct product design, analysis and evaluation using state-of-the-art CAD and CAE software commercial software systems. Students will be given various assignments to learn how to represent and model the products from geometry perspective, how evaluate and analyze the design solutions from thermal, mechanical and physical perspectives and how to optimize the design solutions in terms of product size, shape and material. (Outcomes a, c and d)

A mini-project will be given to students so that they will go through all the design phases in using computer-aided technologies to achieve design objectives. (Outcomes a to d)

Teaching/Learning Methodology	Outcomes			
	a	b	c	d
Lecture		√	√	√
Tutorial	√		√	√
Case study			√	
Mini-project	√	√	√	√

Assessment Methods in Alignment with Intended Learning Outcomes

Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed (Please tick as appropriate)			
		a	b	c	d
1. Class test	20%	√	√	√	√
2. Written/computer assignment	10%	√	√	√	√
3. Case study	10%			√	
4. Mini-project report/presentation	10%	√	√	√	√
5. Examination	50%	√		√	√
Total	100%				

	Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes: Overall Assessment: 0.50 × End of Subject Examination + 0.50 × Continuous Assessment	
	Examination is adopted to assess students on the overall understanding and the ability of applying the concepts. It is supplemented by the tests, written and computer assignments which provide timely feedbacks to both lecturers and students on various topics of the syllabus. Written reports on various case studies and mini-project are used to assess the students' knowledge in the application of state-of-the-art CAD/CAE software to facilitate the product design and analysis process. Mini-project report and presentation assess the students' ability to assimilate the learnt knowledge for solving a more realistic, open-ended design problem systematically.	
Student Study Effort Expected	Class contact:	
	▪ Lecture	30 Hrs.
	▪ Tutorial	3 Hrs.
	▪ Guided study of CAD/CAE	6 Hrs.
	Other student study effort:	
	▪ Performing CAD/CAE in design (tutorial problems)	20 Hrs.
	▪ Performing modeling of design problems (case studies and mini-project)	24 Hrs.
	▪ Literature search and private study	23 Hrs.
	Total student study effort	106 Hrs.
Reading List and References	1. Michael E. Mortenson, Geometric Modeling, John Wiley & Sons, latest edition. 2. Kunwoo Lee, Principles of CAD/CAM/CAE System, Addison-Wesley Longman, latest edition. 3. Vince Adams and Abraham Askenazi, Building Better Products with Finite Element Analysis, Onword Press, latest edition. 4. J.Y.H. Fuh, Y.F. Zhang, A.Y.C. Nee, M.W. Fu, Computer-aided injection mold design and manufacture, Marcel Dekker, Inc, latest edition.	

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