City University of Hong Kong
Course Syllabus

offered by
Department of Mechanical Engineering
with effect from Semester A 2022 / 23

Part I Course Overview

Course Title:	CAD/CAM/CAE Integration
Course Code:	MNE8112
Course Duration:	1 semester
Credit Units:	3 credits
Level:	R8
Medium of Instruction:	English
Medium of Assessment:	English
Prerequisites: *(Course Code and Title)*	Nil
Precursors: *(Course Code and Title)*	Nil
Equivalent Courses: *(Course Code and Title)*	MBE6001/MNE6001 CAD/CAM Integration
Exclusive Courses: *(Course Code and Title)*	Nil

Part II Course Details

1. Abstract

The aim of this course is to develop a comprehensive understanding of technology underlying Computer Aided Design and Manufacture and Computer Aided Engineering solutions. Students will learn how to apply CAD/CAM/CAE technology to solve integrated design/analysis/manufacturing problems with a significant geometric component.

2. Course Intended Learning Outcomes (CILOs)

(CILOs state what the student is expected to be able to do at the end of the course according to a given standard of performance.)

No.	CILOs	Weighting* (if applicable)	Discovery-enriched curriculum related learning outcomes (please tick where appropriate)		
			A1	*A2*	*A3*
1.	**describe** the mathematical basis for the representation of geometric entities including parametric curves and free-form surfaces.		✓	✓	
2.	**describe** the basic theories and algorithms for solid modelling and other advanced representation schemes.		✓	✓	
3.	**elaborate** the general methodology for integrated CAD/CAE solutions and **apply** the method for typical applications.		✓	✓	
4.	**describe** the techniques in CNC toolpath computation for 3-axis and multi-axis machining with selected topics in advanced CAD/CAM applications.		✓	✓	
5.	**interpret** a design/analysis/manufacturing problem with a significant geometric component, **translate** it into an algorithmic problem, and **apply** relevant techniques to solve it.			✓	✓
** If weighting is assigned to CILOs, they should add up to 100%.*		N.A.			

A1: Attitude
Develop an attitude of discovery/innovation/creativity, as demonstrated by students possessing a strong sense of curiosity, asking questions actively, challenging assumptions or engaging in inquiry together with teachers.

A2: Ability
Develop the ability/skill needed to discover/innovate/create, as demonstrated by students possessing critical thinking skills to assess ideas, acquiring research skills, synthesizing knowledge across disciplines or applying academic knowledge to self-life problems.

A3: Accomplishments
Demonstrate accomplishment of discovery/innovation/creativity through producing /constructing creative works/new artefacts, effective solutions to real-life problems or new processes.

3. Teaching and Learning Activities (TLAs)

(TLAs designed to facilitate students' achievement of the CILOs.)

TLA	Brief Description	CILO No.					Hours/week (if applicable)
		1	2	3	4	5	
Lecture	Lectures covering four major areas on CAD modelling, integrated CAD/CAE solutions, CAM processing, and 3D printing.	✓	✓	✓	✓	✓	2 hrs/week
Tutorial	Tutorials on CAD modelling, including spline-based modelling, subdivision-based modelling and solid modelling.	✓	✓			✓	1 hr/week for 8 weeks
Mini-project	Mini-projects covering various topics on integrated CAD/CAE solutions, CAM, 3D printing and other closely related topics.			✓	✓	✓	1 hr/week for 5 weeks

4. Assessment Tasks/Activities (ATs)

(ATs are designed to assess how well the students achieve the CILOs.)

Assessment Tasks/Activities	CILO No.					Weighting*	Remarks
	1	2	3	4	5		
Continuous Assessment: 40%							
Assignment / Test	✓	✓			✓	15%	
Mini-project			✓	✓	✓	25%	
Examination: 60% (duration: 2 hours)							
Examination	✓	✓	✓	✓	✓	60%	
**The weightings should add up to 100%.*						100%	

For a student to pass the course, at least 30% of the maximum mark for both coursework and examination should be obtained.

5. Assessment Rubrics

(Grading of student achievements is based on student performance in assessment tasks/activities with the following rubrics.)

Applicable to students admitted in Semester A 2022/23 and thereafter

Assessment Task	Criterion	Excellent (A+, A, A-)	Good (B+, B)	Marginal (B-, C+, C)	Failure (F)
1. Examination	Through examination, the students will be evaluated on the knowledge in the fields of CAD/CAM/CAE integration.	High	Significant	Moderate	Not even reaching marginal levels
2. Assignment/ Test	Tutorials mainly covering various topics of lectures on CAD modelling and processing.	High	Significant	Moderate	Not even reaching marginal levels
3. Mini-project	Mini-projects mainly covering topics on integrated CAD/CAE solutions, CAM processing, 3D printing, and other closely related topics.	High	Significant	Moderate	Not even reaching marginal levels

Applicable to students admitted before Semester A 2022/23

Assessment Task	Criterion	Excellent (A+, A, A-)	Good (B+, B, B-)	Fair (C+, C, C-)	Marginal (D)	Failure (F)
1. Examination	Through examination, the students will be evaluated on the knowledge in the fields of CAD/CAM/CAE integration.	High	Significant	Moderate	Basic	Not even reaching marginal levels
2. Assignment/ Test	Tutorials mainly covering various topics of lectures on CAD modelling and processing.	High	Significant	Moderate	Basic	Not even reaching marginal levels
3. Mini-project	Mini-projects mainly covering topics on integrated CAD/CAE solutions, CAM processing, 3D printing, and other closely related topics.	High	Significant	Moderate	Basic	Not even reaching marginal levels

Part III Other Information (more details can be provided separately in the teaching plan)

1. Keyword Syllabus

(An indication of the key topics of the course.)

CAD/CAM systems, Bezier, B-spline and NURBS for curve and surface modelling, subdivision-based modelling, CSG and B-Rep for solid modelling, algorithms for curve/curve intersection, curve/surface intersection and surface/surface intersection, isogeometric analysis for integrated CAD/CAE solutions with typical applications in computational mechanics and thermal analysis, algorithms for 3-axis and multi-axis toolpath extraction, data processing for 3D printing.

2. Reading List

2.1 Compulsory Readings

(Compulsory readings can include books, book chapters, or journal/magazine articles. There are also collections of e-books, e-journals available from the CityU Library.)

None

2.2 Additional Readings

(Additional references for students to learn to expand their knowledge about the subject.)

1.	Les Piegl and Wayne Tiller, "The NURBS Book", Springer-Verlag Berlin, Heidelberg, 1997.
2.	David F. Rogers, “An Introduction to NURBS : with Historical Perspectives”, Academic Press, San Francisco, 2001.
3.	I. Zeid, “Mastering CAD/CAM with Engineering Subscription Card”, McGraw-Hill, 2004.
4.	J. Austin Cottrell, Thomas J. R. Hughes, Yuri Bazilevs, "Isogeometric Analysis: Toward Integration of CAD and FEA", John Wiley & Sons, 2009.
5.	Christopher G. Provatidis, “Precursors of Isogeometric Analysis: Finite Elements, Boundary Elements, and Collocation Methods”, Springer, 2019.
6.	I. Gibson, D. Rosen and B. Stucker, "Additive Manufacturing Technologies - 3D Printing, Rapid Prototyping, and Direct Digital Manufacturing", Springer-Verlag New York, 2015.
7.	Computer Methods in Applied Mechanics and Engineering, Elsevier Science.
8.	Computer-Aided Design Journal, Elsevier Science.