

MNE8112: CAD/CAM/CAE INTEGRATION

Effective Term

Semester A 2025/26

Part I Course Overview

Course Title

CAD/CAM/CAE Integration

Subject Code

MNE - Mechanical Engineering

Course Number

8112

Academic Unit

Mechanical Engineering (MNE)

College/School

College of Engineering (EG)

Course Duration

One Semester

Credit Units

3

Level

R8 - Research Degree

Medium of Instruction

English

Medium of Assessment

English

Prerequisites

Nil

Precursors

Nil

Equivalent Courses

MNE6001 CAD/CAM Integration

Exclusive Courses

Nil

Part II Course Details

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.

Course Intended Learning Outcomes (CILOs)

CILOs	Weighting (if app.)	DEC-A1	DEC-A2	DEC-A3
1	describe the mathematical basis for the representation of geometric entities including parametric curves and free-form surfaces.	x	x	
2	describe the basic theories and algorithms for solid modelling and other advanced representation schemes.	x	x	
3	elaborate the general methodology for integrated CAD/CAE solutions and apply the method for typical applications.	x	x	
4	describe the techniques in CNC toolpath computation for 3-axis and multi-axis machining with selected topics in advanced CAD/CAM applications.	x	x	
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.		x	x

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 real-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.

Learning and Teaching Activities (LTAs)

LTAs	Brief Description	CILO No.	Hours/week (if applicable)
1	Lecture	Lectures covering four major areas on CAD modelling, integrated CAD/CAE solutions, CAM processing, and 3D printing.	1, 2, 3, 4, 5 2 hrs/week

2	Tutorial	Tutorials on CAD modelling, including spline-based modelling, subdivision-based modelling and solid modelling.	1, 2, 5	1 hr/week for 8 weeks
3	Mini-project	Mini-projects covering various topics on integrated CAD/CAE solutions, CAM, 3D printing and other closely related topics.	3, 4, 5	1 hr/week for 5 weeks

Assessment Tasks / Activities (ATs)

ATs		CILO No.	Weighting (%)	Remarks ("- for nil entry)	Allow Use of GenAI?
1	Assignment / Test	1, 2, 5	15	-	Yes
2	Mini-project	3, 4, 5	25	-	Yes

Continuous Assessment (%)

40

Examination (%)

60

Examination Duration (Hours)

2

Minimum Continuous Assessment Passing Requirement (%)

30

Minimum Examination Passing Requirement (%)

30

Additional Information for ATs

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

Assessment Rubrics (AR)**Assessment Task**

Examination (for students admitted before Semester A 2022/23 and in Semester A 2024/25 & thereafter)

Criterion

Through examination, the students will be evaluated on the knowledge in the fields of CAD/CAM/CAE integration.

Excellent

(A+, A, A-) High

Good

(B+, B, B-) Significant

Fair

(C+, C, C-) Moderate

Marginal

(D) Basic

Failure

(F) Not even reaching marginal levels

Assessment Task

Assignment/ Test (for students admitted before Semester A 2022/23 and in Semester A 2024/25 & thereafter)

Criterion

Tutorials mainly covering various topics of lectures on CAD modelling and processing.

Excellent

(A+, A, A-) High

Good

(B+, B, B-) Significant

Fair

(C+, C, C-) Moderate

Marginal

(D) Basic

Failure

(F) Not even reaching marginal levels

Assessment Task

Mini-project (for students admitted before Semester A 2022/23 and in Semester A 2024/25 & thereafter)

Criterion

Mini-projects mainly covering topics on integrated CAD/CAE solutions, CAM processing, 3D printing, and other closely related topics.

Excellent

(A+, A, A-) High

Good

(B+, B, B-) Significant

Fair

(C+, C, C-) Moderate

Marginal

(D) Basic

Failure

(F) Not even reaching marginal levels

Assessment Task

Examination (for students admitted from Semester A 2022/23 to Summer Term 2024)

Criterion

Through examination, the students will be evaluated on the knowledge in the fields of CAD/CAM/CAE integration.

Excellent

(A+, A, A-) High

Good

(B+, B) Significant

Marginal

(B-, C+, C) Moderate

Failure

(F) Not even reaching marginal levels

Assessment Task

Assignment/ Test (for students admitted from Semester A 2022/23 to Summer Term 2024)

Criterion

Tutorials mainly covering various topics of lectures on CAD modelling and processing.

Excellent

(A+, A, A-) High

Good

(B+, B) Significant

Marginal

(B-, C+, C) Moderate

Failure

(F) Not even reaching marginal levels

Assessment Task

Mini-project (for students admitted from Semester A 2022/23 to Summer Term 2024)

Criterion

Mini-projects mainly covering topics on integrated CAD/CAE solutions, CAM processing, 3D printing, and other closely related topics.

Excellent

(A+, A, A-) High

Good

(B+, B) Significant

Marginal

(B-, C+, C) Moderate

Failure

(F) Not even reaching marginal levels

Part III Other Information

Keyword Syllabus

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.

Reading List

Compulsory Readings

Title	
1	N.A.

Additional Readings

Title	
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.