Course Specification
(Bachelor)

Course Title:	**Computer Aided Design and Manufacturing**
Course Code:	**INE 5372**
Program:	**Bachelor of Industrial Engineering**
Department:	**Industrial Engineering Department**
College:	**College of Engineering**
Institution:	**King Khalid University**
Version:	2
Last Revision Date:	**23 OCTOBER 2025**

Table of Contents

A. General information about the course:

1. Course Identification

1. Credit hours: (3)					
2. Course type					
A.	☐ University	☐ College	■ Department	☐ Track	☐ Others
B.	■ Required		☐ Elective		
3. Level/year at which this course is offered: (Level 10/year 3)					

4. Course General Description:

This course is designed to introduce the fundamental concepts of Computer-Aided Design and Manufacturing (CAD/CAM) using computer numerical controlled (CNC) machines. The students will use their acquired CAD/CAM knowledge to complete a simple design/manufacturing project throughout the course. This course teaches students the principles and applications of CAD/CAM in product and manufacturing design and is highly relevant to future trends in automation and manufacturing processes. It teaches the underlying theory of CAD/CAM, but most importantly teaches students the skills needed to design using CAD/CAM. The department operates a number of design platforms, most notably SolidWorks and SolidCAM software. The course teaches the essential steps that one takes to develop a product from concept to manufacture starting with CAD, and progressing to simulation, using CAM and CAE software support. This course will enable students to explore and gain further understanding of how CAD/CAM can be used in Manufacturing Industry. This course will also provide students with opportunity to explore innovation in design using SolidWorks.

5. Pre-requirements for this course (if any)**:**

Engineering Drawing ME 2311

6. Co-requisites for this course (if any)**:**

---

7. Course Main Objective(s):

Course objective: To Introduce the students to the standard terminologies, conventions, processes, operations, design and operational characteristics of key hardware components, programming techniques, applications, merits and demerits of Computer Numerical Controlled (CNC) machines.	
Introduction:	Need of NC technology, Fundamental concepts in numeric control: structure and functions of NC System, advantages of NC technology over conventional manufacturing.

NC Machine Tools:	Types, Definition and designation of control axes, Special constructional and design characteristics of NC machine tools, Standard tooling used for NC turning and milling centers.
NC Part Programming:	Work holding and tool setting procedure for NC turning and milling centers, Tool zero presetting, Block formats and introduction to ISO based G & M codes for NC part programming, Concepts of tool length and radius compensation, Standard canned cycles used in CNC turning and milling centers, Introduction to automatic NC part program generation from CAD models using standard CAD/CAM software for machining of surfaces, molds and dies etc.
Computer Numerical Control of Machine Tools:	Types and functions of computer numeric control (CNC), Types and functions of direct numeric control (DNC), Need of adaptive control types, functions and types of adaptive control, its uses & benefits, Advantages of combined CNC/DNC systems.
System Devices:	Drives, Feedback devices, Interpolator systems, Control loop circuit elements in point to point (PTP) and contouring system, Interpolation schemes for linear and circular interpolations.

2. Teaching mode (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	60	100
2	E-learning		
3	Hybrid ● Traditional classroom ● E-learning		
4	Distance learning		

3. Contact Hours (based on the academic semester)

No	Activity	Contact Hours
1.	**Lectures**	30
2.	**Laboratory/Tutorial**	30
3.	**Field**	
4.	**Others (specify)**	
Total		60

B. Course Learning Outcomes (CLOs), Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Code of PLOs aligned with the program	Teaching Strategies	Assessment Methods
1.0	**Knowledge and understanding**			
1.1	Introduction to automation and CAD/CAM concepts and terminology	K 1,k2		Assignments/ Activities / presentation Quizzes/ Midterm exam/ Practical exam / Final test
2.0	**Skills**			
2.1	Use the concepts of machining for the purpose of selection of appropriate machining centers, machining parameters, select appropriate cutting tools for CNC milling and turning 8 equipment, set-up, program, and operate CNC milling and turning equipment. Use advanced softwares	S1, S2		Assignments/ Activities / presentation Quizzes/ Midterm exam/ Practical exam / Final test
2.2	Create and validate NC part program data using manual data input (MDI) and automatically using standard commercial CAM package for manufacturing of	S3		Assignments/ Activities / presentation Quizzes/ Midterm exam/ Practical exam / Final test

Code	Course Learning Outcomes	Code of PLOs aligned with the program	Teaching Strategies	Assessment Methods
	required component using CNC milling or turning applications.			
2.3	Produce an industrial component by interpreting 3D part model/ part drawings using Computer Aided Manufacturing technology through programming, setup, and ensuring safe operation of Computer Numerical Control (CNC) machine tools	S3		Assignments/ Activities / presentation Quizzes/ Midterm exam/ Practical exam / Final test
2.4	Create and demonstrate the technical documentation for design/ selection of suitable drive technologies, precision components and an overall CNC machine tool system for automation of machining operations using appropriate multi-axis CNC technology.	S4		Assignments/ Activities / presentation Quizzes/ Midterm exam/ Practical exam / Final test
2.5	Write NC part program for the given contour	S2, S3, s4		Assignments/ Activities / presentation Quizzes/ Midterm exam/ Practical exam / Final test
3.0	**Skills**			

Code	Course Learning Outcomes	Code of PLOs aligned with the program	Teaching Strategies	Assessment Methods
3.1	Work individually or within a team and communicate effectively to perform the assigned tasked (Homework/Practical activity / Group presentation)	V4		Presentation and small project

C. Course Content

No	List of Topics	Contact Hours
1.	Introduction to CAD and CAM	**12**
2.	Introduction to CNC machines	**12**
3.	CNC Turning machine components, tools and Turning Programming	**12**
4.	CNC Milling machines components, tools and Milling Programming	**12**
5.	CNC drilling processes, tools, and part programming	**12**
Total		**60**

D. Students Assessment Activities

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	Mid Exams	7, 12	30
2.	Assignments	4, 6, 7	5
3.	Quizzes {1, 2, & 3}	3,5,8	10
4.	Lab	16	15
5.	Final Exam	18	40

*Assessment Activities (i.e., Written test, oral test, oral presentation, group project, essay, etc.).

E. Learning Resources and Facilities

1. References and Learning Resources

Essential References	Bi, Z., & Wang, X. (2020). *Computer aided design and manufacturing*. John Wiley & Sons.
Supportive References	Chang, K. H. (2021). *Machining Simulation Using SOLIDWORKS CAM 2021*. SDC Publications.

	Kyratsis, P., Manavis, A., & Davim, J. P. (Eds.). (2025). *CAD/CAM: Computer-Aided Design and Manufacturing* (Vol. 17). Walter de Gruyter GmbH & Co KG.
Electronic Materials	**Lectures on blackboard**
Other Learning Materials	Al-Hassiny, A. (2022). Fundamentals of computer-aided design (CAD) in dental healthcare: from basics to beyond. In *3D printing in oral health science: applications and future directions* (pp. 93-119). Cham: Springer International Publishing.

2. Required Facilities and equipment

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	• Classroom with 50 seats Laboratory with 25 seats
Technology equipment (projector, smart board, software)	• Laptop / Computer system Multimedia teaching aids – LCD Project, speakers
Other equipment (depending on the nature of the specialty)	

F. Assessment of Course Quality

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	Students	Indirect (through course evaluation survey)
Effectiveness of Students assessment	Faculty and Quality Committee	Direct (through Rubrics)
Quality of learning resources	Students and faculty	Indirect (through university experience and mission-vision-PEO surveys)
The extent to which CLOs have been achieved		
Other		

Assessors (Students, Faculty, Program Leaders, Peer Reviewers, Others (specify)

Assessment Methods (Direct, Indirect)

G. Specification Approval

COUNCIL /COMMITTEE	**REVIEWED BY CURRICULUM COMMITTEE** **APPROVED BY QUALITY COMMITTEE**
REFERENCE NO.	**9-6-47**
DATE	**25/06/1447**