



## 31. Course Specification of CAD/CAM

I. Course Identification and General Information:						
1.	Course Title:	CAD/CAM.				
2.	Course Code & Number:	ME233.				
3.	Credit Hours:	C.H				TOTAL CR. HRS.
		Th.	Seminar/Tu.	Pr	Tr.	
		2	-	2	-	
4.	Study level/ semester at which this course is offered:	Third year - First Semester.				
5.	Pre –requisite (if any):	Manufacturing Processes - II, Mechanics of Materials - I and Machine Drawing				
6.	Co –requisite (if any):	Mechanics of Materials - II (ME234).				
7.	Program (s) in which the course is offered:	Mechanical Engineering Program.				
8.	Language of teaching the course:	English Language.				
9.	Location of teaching the course:	Mechanical Engineering Department.				
10.	Prepared By:	Associate Prof. Dr. Khalil Al-Hatab				
11.	Date of Approval:					

II. Course Description:
<p>This course is an introduction to the rapidly growing fields of CAD/CAM systems and <b>it</b> emphasizes the development of skills in computer-integrated design and manufacturing. This course covers the following topics: introduction to CAD/ CAM, Computer Graphical Systems, Geometrical Modeling, Curves, Wire Frame Modeling, Surface and Solid Modeling, Structures of NC and CNC Machine Tools, Positioning Systems, Manual Part Programming, Computerized Part Programming. It provides experience <b>in</b> CAD/CAM, Reverse Engineering and Rapid Prototyping.</p>

	III. Course Intended learning outcomes (CILOs) of the course	Referenced PILOs)
a1	Gain an understanding the fundamental mathematical theories and computer algorithms underlying CAD/CAM tools.	A1
a2	Explain fundamental theories and technologies that are the foundation of today's CAD/CAM systems.	A2

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<b>a3</b>	Classify the available tools offered by CAD/CAM systems to speed up the product design, modeling and the manufacturing process.	<b>A4</b>
<b>b1</b>	Investigate the required skills to link theoretical and practical knowledge of CAD/CAM systems to meet the desired needs in engineering design and/manufacturing process.	<b>B1</b>
<b>b2</b>	Analyze the manufacturing problems concerning with CAD/CAM system.	<b>B2</b>
<b>c1</b>	Use efficiently the CAD/ CAM system (Unigraphics NX 12) to conduct an entire product-development process of middle to large-scale project from the very early conceptual design till the final machining G-code generation or rapid-prototyping operation in a team-work environment.	<b>C1</b>
<b>c2</b>	Employ on-hand skills opportunities and trainings on some popular CAD/CAM equipment and packages to perform project tasks.	<b>C2</b>
<b>c3</b>	Select proper tolerances and safety rules for industrial applications based on science and technology.	<b>C3</b>
<b>d1</b>	Cooperate effectively as a part of a team in design, prototyping and machine programming tasks.	<b>D1</b>
<b>d2</b>	Review the relevant literature resources and present finding in seminars and reports.	<b>D4</b>
<b>d3</b>	Communicate effectively.	<b>D5</b>

<b>(A) Alignment Course Intended Learning Outcomes of Knowledge and Understanding to Teaching Strategies and Assessment Strategies:</b>		
Course Intended Learning Outcomes	Teaching strategies	Assessment Strategies
<b>a1.</b> Gain an understanding the fundamental mathematical theories and computer algorithms underlying CAD/CAM tools.	Lectures, Tutorials Laboratory, Seminars	Examinations, Laboratory Reports, Homework Presentations
<b>a2.</b> Explain fundamental theories and technologies that are the foundation of today's CAD/CAM systems.		

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<p><b>a3.</b> Classify the available tools offered by CAD/CAM systems to speed up the product design, modeling and the manufacturing process.</p>		
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**(B) Alignment Course Intended Learning Outcomes of Intellectual Skills to Teaching Strategies and Assessment Strategies:**

Course Intended Learning Outcomes	Teaching strategies	Assessment Strategies
<p><b>b1.</b> Investigate the required skills to link theoretical and practical knowledge of CAD/CAM systems to meet the desired needs in engineering design and/manufacturing process.</p>	Lectures, Tutorials Laboratory, Seminars	Examinations, Laboratory Reports, Homework Presentations
<p><b>b2.</b> Analyze the manufacturing problems concerning with CAD/CAM system.</p>		

**(C) Alignment Course Intended Learning Outcomes of Professional and Practical Skills to Teaching Strategies and Assessment Strategies:**

Course Intended Learning Outcomes	Teaching strategies	Assessment Strategies
<p><b>c.1</b> Use efficiently the CAD/ CAM system (Unigraphics NX 12) to conduct an entire product-development process of middle to large- scale project from the very early conceptual design till the final machining G-code generation or rapid-prototyping operation in a team-work environment.</p>	Lectures, Tutorials Laboratory, Seminars	Examinations, Laboratory Reports, Homework Presentations
<p><b>c.2</b> Employ on-hand skills opportunities and trainings on some popular CAD/CAM equipment and packages to perform project tasks.</p>		

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<b>c.3</b> <b>Select proper</b> tolerances and safety rules for industrial applications based on science and technology.		
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<b>(D) Alignment Course Intended Learning Outcomes of Transferable Skills to Teaching Strategies and Assessment Strategies:</b>		
Course Intended Learning Outcomes	Teaching strategies	Assessment Strategies
<b>d1.</b> Cooperate effectively as a part of a team in design, prototyping and machine programming tasks.	Laboratory Seminars	Reports Presentations
<b>d2.</b> Review the relevant literature resources and present finding in seminars and reports.		
<b>D3.</b> Communicate effectively.		

<b>IV. Course Content:</b>					
<b>A – Theoretical Aspect:</b>					
Order	Units/Topics List	Learning Outcomes	Sub Topics List	Number of Weeks	Contact Hours
1	Introduction to CAD/CAM	a1,a2,a3,b1,b2,c1,c2,c3,d2	- Overview of Course - Definitions - Product Cycle - Design Process - Scope of CAD / CAM - Components of CAD/CAM.	1	2
2	Basic Concepts of Graphics Programming	a1,a2,a3,b1,b2,c1,c2,c3,d2	- Graphics Libraries - Coordinate Systems - Window and Viewport - Output Primitives - Transformation Matrix - Graphics User Interface.	1	2

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3	Geometric Modeling Systems	a1,a2,a3,b1,b2,c1,c2,c3,d2	<ul style="list-style-type: none"> <li>- Wireframe Modeling</li> <li>- Surface Modeling</li> <li>- Solid Modeling</li> <li>- Surface Modeling</li> <li>- Assembly Modeling</li> </ul>	1	2
4	Representation & Manipulation of Curves	a1,a2,a3,b1,b2,c1,c2,c3,d2	<ul style="list-style-type: none"> <li>- Types of Curve Equations</li> <li>- Conic Sections</li> <li>- Hermite Curves</li> <li>- Bezier Curves</li> <li>- B-Spline Curves</li> </ul>	1	2
5	Representation & Manipulation of Surfaces	a1,a2,a3,b1,b2,c1,c2,c3,d2	<ul style="list-style-type: none"> <li>- Types of Surface Equations</li> <li>- Bilinear Surfaces</li> <li>- Coon's &amp; Bicubic Patch</li> <li>- Bezier Surfaces</li> <li>- B-Spline Surfaces</li> </ul>	1	2
6	Finite Element Analysis & Optimization	a1,a2,a3,b1,b2,c1,c2,c3,d2	<ul style="list-style-type: none"> <li>- Formulation of the FEM</li> <li>- Finite Element Modeling</li> <li>- Mesh Generation</li> <li>- Optimization</li> <li>- Treatments of the Constrains</li> <li>- Search Method</li> <li>- Simulated Annealing</li> <li>- Genetic Algorithm</li> <li>- Structural optimization</li> </ul>	2	4
7	Mid-Term Exam	a1,a2,a3,b1,b2,c1,c2,c3,d2	<ul style="list-style-type: none"> <li>- The First Seven Chapters</li> </ul>	1	1
8	CAD/CAM Exchange	a1,a2,a3,b1,b2,c1,c2,c3,d2	<ul style="list-style-type: none"> <li>- Data Evaluation &amp; Exchange format</li> <li>- IGES Representations &amp; Structure</li> <li>- STEP Architecture</li> <li>- ACIS &amp; DXF.</li> </ul>	1	2

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9	Fundamentals of Numerical Control	a1,a2,a3,b1,b2,c1,c2,c3,d2	<ul style="list-style-type: none"> <li>- Overview of NC</li> <li>- Principles of NC Systems</li> <li>- Types of NC Systems</li> <li>- Numerical-Control Systems</li> <li>- NC Controllers</li> <li>- Components of NC Systems</li> </ul>	1	2
10	Tooling of Numeric Control Machines	a1,a2,a3,b1,b2,c1,c2,c3,d2	<ul style="list-style-type: none"> <li>- Principle of operation of NC</li> <li>- Machinability of Work Materials</li> <li>- Tool Characteristics</li> <li>- Modern Cutting Tools</li> <li>- Work Holding Devices</li> <li>- 2D and 3D Machining on NC</li> </ul>	1	2
11	NC Programming	a1,a2,a3,b1,b2,c1,c2,c3,d2	<ul style="list-style-type: none"> <li>- NC Part Programming</li> <li>- Manual Part Programming</li> <li>- Computer-Assisted Part Programming</li> <li>- CAD Part Programming</li> <li>- NC Tool-Path Verification</li> <li>- Generation of Tool Path</li> <li>- Optimization of Tool Path</li> </ul>	2	4
12	Rapid Prototyping and Manufacturing	a1,a2,a3,b1,b2,c1,c2,c3,d2	<ul style="list-style-type: none"> <li>- Rapid Prototyping Applications</li> <li>- Stereo Lithography Process</li> </ul>	1	2
13	CAD/CAM Applications	a1,a2,a3,b1,b2,c1,c2,c3,d2	<ul style="list-style-type: none"> <li>- Computer Aided Inspection</li> <li>- Reverse Engineering</li> <li>- Computer Aided Process Planning</li> </ul>	1	2
14	Final Exam	a1,a2,a3,b1,b2,c1,c2,c3,d2	All the Chapters	1	2
<b>Number of Weeks /and Units Per Semester</b>				<b>16</b>	<b>32</b>

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<b>B - Practical Aspect:</b>				
<b>Order</b>	<b>Tasks/ Experiments</b>	<b>Number of Weeks</b>	<b>Contact Hours</b>	<b>Learning Outcomes</b>
1	Introduction	1	2	a1,a2,b2,c1.c2,c3,d1,d2,d3
2	Lab 1: Starting NX	1	2	a1,a2,b2,c1.c2,c3,d1,d2,d3
3	Lab 2: Modeling Process with NX	1	2	a1,a2,b2,c1.c2,c3,d1,d2,d3
4	Lab 3: Sketch	1	2	a1,a2,b2,c1.c2,c3,d1,d2,d3
5	Lab 4: Creating 3D Geometry	1	2	a1,a2,b2,c1.c2,c3,d1,d2,d3
6	Lab 5: Parametric Modification	1	2	a1,a2,b2,c1.c2,c3,d1,d2,d3
7	Practical Mid-Term Exam	1	2	a1,a2,b2,c1.c2,c3,d1,d2,d3
8	Lab 6: Assembly Design	1	2	a1,a2,b2,c1.c2,c3,d1,d2,d3
9	Lab 7: Creating Drawing Views	1	2	a1,a2,b2,c1.c2,c3,d1,d2,d3
10	Lab 8: Turning	1	2	a1,a2,b2,c1.c2,c3,d1,d2,d3
11	Lab 9: Milling (1)	1	2	a1,a2,b2,c1.c2,c3,d1,d2,d3
12	Lab 10: Milling (2)	1	2	a1,a2,b2,c1.c2,c3,d1,d2,d3
13	Practical Final Term Exam	1	2	a1,a2,b2,c1.c2,c3,d1,d2,d3
14	Review	1	2	a1,a2,b2,c1.c2,c3,d1,d2,d3
<b>Number of Weeks /and Units Per Semester</b>		<b>14</b>	<b>28</b>	

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<b>V. Teaching strategies of the course:</b>	
–	Lectures
–	Tutorials
–	Reports & sheets
–	Laboratories
–	Seminars

<b>VI. Assignments:</b>				
No	Assignments	Aligned CILOs(symbols)	Week Due	Mark
1.	Homework 1	a1,a2,a3,b1,b2,c3,d2,d3	2 <sup>nd</sup>	1
2.	Homework 2	a1,a2,a3,b1,b2,c1,c3,d2,d3	3 <sup>rd</sup>	1
3.	Homework 3	a1,a2,a3,b1,b2,c1,c3,d2,d3	4 <sup>th</sup>	1
4.	Homework 4	a1,a2,a3,b1,b2,c1,c3,d2,d3	5 <sup>th</sup>	1
5.	Homework 5	a1,a2,a3,b1,b2,c3,d2,d3	6 <sup>th</sup>	1
6.	Homework 6	a1,a2,a3,b1,b2,c3,d2,d3	7 <sup>th</sup>	1
7.	Homework 7	a1,a2,a3,b1,b2,c3,d2,d3	8 <sup>th</sup>	1
8.	Homework 8	a1,a2,a3,b1,b2,c3,d2,d3	9 <sup>th</sup>	1
9.	Homework 9	a1,a2,a3,b1,b2,c3,d2,d3	10 <sup>th</sup>	1
10.	Homework 10	a1,a2,a3,b1,b2,c3,d2,d3	11 <sup>th</sup> -12 <sup>th</sup>	1
11.	Homework 11	a1,a2,a3,b1,b2,c3,d2,d3	13 <sup>th</sup>	0.5
12.	Homework 12	a1,a2,a3,b1,b2,c3,d2,d3	14 <sup>th</sup>	0.5
<b>Total</b>				<b>10</b>

<b>VII. Schedule of Assessment Tasks for Students During the Semester:</b>					
No.	Assessment Method	Week Due	Mark	Proportion of Final Assessment	Aligned Course Learning Outcomes
1	Homework 1 to Homework 14	2 <sup>nd</sup> to 15 <sup>th</sup>	10	6.67%	a1,a2,a3,b1,b2,c3,d2,d3
2	Lab reports 1- 9	4 <sup>th</sup> to 13 <sup>th</sup>	10	6.67%	a1,a2,b2,c1.c2,c3,d1,d2,d3

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3	Quizzes 1, 2, 3	4 <sup>th</sup> , 10 <sup>th</sup> , 13 <sup>th</sup>	10	6.67%	a1,a2,a3,b1,b2,c3,d2,d3
4	Mid-Term Exam	8 <sup>th</sup>	20	13.33%	a1,a2,a3,b1,b2,c3,d2,d3
5	Practical Mid-Term Exam	7 <sup>th</sup>	10	6.67%	a1,a2,b2,c1.c2,c3,d1,d2,d3,
6	Practical Final Exam	13 <sup>th</sup>	15	10%	a1,a2,b2,c1.c2,c3,d1,d2,d3,
7	Final exam	15 <sup>th</sup>	75	50%	a1,a2,a3,b1,b2,c3,d2,d3
<b>Total</b>			<b>150</b>	<b>100%</b>	

<b>VIII. Learning Resources:</b>	
<ul style="list-style-type: none"> <li>Written in the following order: (Author - Year of publication – Title – Edition – Place of publication – Publisher).</li> </ul>	
<b>1- Required Textbook(s) (maximum two ).</b>	
	1. Kunwoo Lee, 1999, Principles of CAD/CAM/CAE Systems, Addison Wesley Longman, Inc.
<b>2- Essential References.</b>	
	<ol style="list-style-type: none"> <li>Ibrhim Zeid, 2004, Mastering CAD/CAM, McGraw Hill international.</li> <li>Ibrhim Zeid, “CAD/CAM Theory and Practice”, McGraw Hill international.</li> <li>Thomas O. Boucher, 1996, “Computer Automation in Manufacturing an Introduction”, Chapman &amp; Hall.</li> <li>Tien-Chien Chang, Richard A. Wysk, Hsu-Pin Wang, 2005, “Computer-Aided Manufacturing”, 3rd Edition, Prentice Hall.</li> <li>P. N. Rao “CAD/CAM principles and operations”, Tata McGraw Hil.</li> <li>Groover, M.P., 2015, “Automation, Production Systems and Computer-Integrated Manufacturing”, 4<sup>th</sup> Ed., Prentice-Hall.</li> </ol>
<b>3- Electronic Materials and Web Sites etc.</b>	
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<b>I. Course Policies:</b>	
<b>1</b>	<p><b>Class Attendance:</b></p> <p>- The student should be attending not less than 75% of total contact hours of the subject, otherwise he will not able to take exam and <b>be considered</b> as <b>an</b> exam failure. If the student is absent due to illness, he/she should bring <b>an approved</b> statement from university Clinic.</p>

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2	<p><b>Tardy:</b></p> <p>- For <b>lateness</b> in attending the class, the student will be initially <b>notified</b>. If he <b>repeats</b> late in attending class <b>he will be considered absent</b>.</p>
3	<p><b>Exam Attendance/Punctuality:</b></p> <p>- The student should attend the exam on time. He is <b>permitted</b> to attend the exam half one hour from exam beginning, after that he/she will not <b>be</b> permitted to take exam and he/she <b>is considered</b> absent in <b>the</b> exam.</p>
4	<p><b>Assignments &amp; Projects:</b></p> <p>- In general one assignment is given after each chapter of a course. The student should submit the assignment on time, mostly one week after <b>giving</b> the assignment</p>
5	<p><b>Cheating:</b></p> <p>- For cheating in exam, the student <b>is</b> considered as <b>failure</b>. <b>In case</b> the cheating <b>is</b> repeated three times during study the student will <b>be disengaged</b> from the Faculty</p>
6	<p><b>Plagiarism:</b></p> <p>Plagiarism is the attending of the student the exam of a course instead of other student. If the examination committee <b>proved</b> a plagiarism of a student, he will be disengaged from the Faculty. The final disengagement of the student from the Faculty should be confirmed from the Student <b>Affair Council</b> of the university.</p>
7	<p><b>Other policies:</b></p> <ul style="list-style-type: none"> <li>- The mobile phone is not allowable <b>to be used</b> during class lecture. It must <b>be switched off</b>, otherwise the student will <b>be ordered</b> to leave the lecture room.</li> <li>- The mobile phone is not allowed <b>to be taken during the examination time</b>.</li> <li>- Lecture notes and assignments <b>may be</b> given directly to students using soft or hard copy.</li> </ul>

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Reviewed By	<u>Vice Dean for Academic Affairs and Post Graduate Studies Asst. Prof. Dr. Tarek A. Barakat</u> <u>President of Quality Assurance Unit: Assoc. Prof. Dr. Mohammed Algorafi</u> <u>Head of Mechanical Engineering Department: Asst. Prof. Dr. Eng. Hamoud A. Al-Nahari</u>
	<u>Deputy Rector for Academic Affairs Asst. Prof. Dr. Ibrahim AlMutaa</u> <u>Assoc. Prof. Dr. Ahmed Mujahed</u> <u>Asst. Prof. Dr. Munaser Alsubri</u>

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## 31. Course Plan of CAD/CAM

I. Information about Faculty Member Responsible for the Course:						
<b>Name of Faculty Member</b>	Assoc. Prof. Dr. Khalil Al-Hatab	<b>Office Hours</b>				
<b>Location &amp; Telephone No.</b>		SAT	SUN	MON	TUE	WED
<b>E-mail</b>	alhxxxx@yahoo.com					

II. Course Identification and General Information:						
1.	Course Title:	CAD/CAM.				
2.	Course Number & Code:	ME233.				
3.	Credit Hours:	C.H				TOTAL
		Th.	Seminar/Tu.	Pr	Tr.	
		2	-	2	-	
4.	Study level/year at which this course is offered:	Third Year- First Semester.				
5.	Pre –requisite (if any):	Manufacturing Processes - II , Mechanics of Materials - I and Machine Drawing				
6.	Co –requisite (if any):	Mechanics of Materials - II (ME234)				
7.	Program (s) in which the course is offered	Mechanical Engineering program				
8.	Language of teaching the course:	English Language				
9.	System of Study:	Lectures and Practical				
10.	Mode of delivery:	Associate Prof. Dr. Khalil Al-Hatab				
11.	Location of teaching the course:					

**III. Course Description:**

This course is an introduction to the rapidly growing fields of CAD/CAM systems and it emphasizes the development of skills in computer-integrated design and manufacturing. This course covers the following topics: introduction to CAD/ CAM, Computer Graphical Systems, Geometrical Modeling, Curves, Wire Frame Modeling, Surface and Solid Modeling, Structures of NC and CNC Machine Tools, Positioning Systems, Manual Part Programming,

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Computerized Part Programming. It provides experience in CAD/CAM, Reverse Engineering and Rapid Prototyping.

#### IV. Intended learning outcomes (ILOs) of the course:

- Brief summary of the knowledge or skill the course is intended to develop:
  1. **Realize the** fundamentals of CAD/CAM; selecting an appropriate CAD/CAM system and the role of CAD/CAM in contemporary product realization process.
  2. Identify the key trends emerging in the CAD/CAM discipline that will have substantial influence over the design and development of mechanical systems.
  3. **Recognize the** fundamental theories; concepts; procedures and technologies in computer graphics, geometric modeling algorithms, curves and surfaces, meshing algorithms, introductory optimization algorithms, part programming and tool path generation algorithms that are the foundation of today's CAD/CAM systems
  4. Pursue further studies and summarize a unique technology and/or application in the field of CAD/CAM.
  5. **Evaluate using** the suitable ways for solving the engineering problems related to CAD/CAM practices.

#### V. Course Content:

##### A – Theoretical Aspect:

Order	Units/Topics List	Sub Topics List	Number of Weeks	Contact Hours
1	Introduction to CAD/CAM	<ul style="list-style-type: none"> <li>- Overview of Course</li> <li>- Definitions</li> <li>- Product Cycle</li> <li>- Design Process</li> <li>- Scope of CAD / CAM</li> <li>- Components of CAD/CAM.</li> </ul>	1 <sup>st</sup>	2
2	Basic Concepts of Graphics Programming	<ul style="list-style-type: none"> <li>- Graphics Libraries</li> <li>- Coordinate Systems</li> <li>- Window and Viewport</li> </ul>	2 <sup>nd</sup>	2

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		<ul style="list-style-type: none"> <li>- Output Primitives</li> <li>- Transformation Matrix</li> <li>- Graphics User Interface.</li> </ul>		
3	Geometric Modeling Systems	<ul style="list-style-type: none"> <li>- Wireframe Modeling</li> <li>- Surface Modeling</li> <li>- Solid Modeling</li> <li>- Surface Modeling</li> <li>- Assembly Modeling</li> </ul>	3 <sup>rd</sup>	2
4	Representation & Manipulation of Curves	<ul style="list-style-type: none"> <li>- Types of Curve Equations</li> <li>- Conic Sections</li> <li>- Hermite Curves</li> <li>- Bezier Curves</li> <li>- B-Spline Curves</li> </ul>	4 <sup>th</sup>	2
5	Representation & Manipulation of Surfaces	<ul style="list-style-type: none"> <li>- Types of Surface Equations</li> <li>- Bilinear Surfaces</li> <li>- Coon's &amp; Bicubic Patch</li> <li>- Bezier Surfaces</li> <li>- B-Spline Surfaces</li> </ul>	5 <sup>th</sup>	2
6	Finite Element Analysis & Optimization	<ul style="list-style-type: none"> <li>- Formulation of the FEM</li> <li>- Finite Element Modeling</li> <li>- Mesh Generation</li> <li>- Optimization</li> <li>- Treatments of the Constrains</li> <li>- Search Method</li> <li>- Simulated Annealing</li> <li>- Genetic Algorithm</li> <li>- Structural optimization</li> </ul>	6 <sup>th</sup> , 7 <sup>th</sup>	4
7	Mid-Term Exam	<ul style="list-style-type: none"> <li>- The First Seven Chapters</li> </ul>	8 <sup>th</sup>	1
8	CAD/CAM Exchange	<ul style="list-style-type: none"> <li>- Data Evaluation &amp; Exchange format</li> <li>- IGES Representations &amp; Structure</li> <li>- STEP Architecture</li> <li>- ACIS &amp; DXF.</li> </ul>	9 <sup>th</sup>	2

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9	Fundamentals of Numerical Control	<ul style="list-style-type: none"> <li>- Overview of NC</li> <li>- Principles of NC Systems</li> <li>- Types of NC Systems</li> <li>- Numerical-Control Systems</li> <li>- NC Controllers</li> <li>- Components of NC Systems</li> </ul>	10 <sup>th</sup>	2
10	Tooling of Numeric Control Machines	<ul style="list-style-type: none"> <li>- Principle of operation of NC</li> <li>- Machinability of Work Materials</li> <li>- Tool Characteristics</li> <li>- Modern Cutting Tools</li> <li>- Work Holding Devices</li> <li>- 2D and 3D Machining on NC</li> </ul>	11 <sup>th</sup>	2
11	NC Programming	<ul style="list-style-type: none"> <li>- NC Part Programming</li> <li>- Manual Part Programming</li> <li>- Computer-Assisted Part Programming</li> <li>- CAD Part Programming</li> <li>- NC Tool-Path Verification</li> <li>- Generation of Tool Path</li> <li>- Optimization of Tool Path</li> </ul>	12 <sup>th</sup> ,13 <sup>th</sup>	4
12	Rapid Prototyping and Manufacturing	<ul style="list-style-type: none"> <li>- Rapid Prototyping</li> <li>- Applications</li> <li>- Stereo Lithography Process</li> </ul>	14 <sup>th</sup>	2
13	CAD/CAM Applications	<ul style="list-style-type: none"> <li>- Computer Aided Inspection</li> <li>- Reverse Engineering</li> <li>- Computer Aided Process Planning</li> </ul>	15 <sup>th</sup>	2
14	Final Exam	All the Chapters	16 <sup>th</sup>	2
<b>Number of Weeks /and Units Per Semester</b>			<b>16</b>	<b>32</b>

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<b>B - Practical Aspect:</b>			
<b>Order</b>	<b>Tasks/ Experiments</b>	<b>Number of Weeks</b>	<b>Contact hours</b>
1	Introduction	1 <sup>st</sup>	2
2	Lab 1: Starting NX	2 <sup>nd</sup>	2
3	Lab 2: Modeling Process with NX	3 <sup>rd</sup>	2
4	Lab 3: Sketch	4 <sup>th</sup>	2
5	Lab 4: Creating 3D Geometry	5 <sup>th</sup>	2
6	Lab 5: Parametric Modification	6 <sup>th</sup>	2
7	Practical Mid-Term Exam	7 <sup>th</sup>	2
8	Lab 6: Assembly Design	8 <sup>th</sup>	2
9	Lab 7: Creating Drawing Views	9 <sup>th</sup>	2
10	Lab 8: Turning	10 <sup>th</sup>	2
11	Lab 9: Milling (1)	11 <sup>th</sup>	2
12	Lab 10: Milling (2)	12 <sup>th</sup>	2
13	Practical Final Term Exam	13 <sup>th</sup>	2
14	Review	14 <sup>th</sup>	2
<b>Number of Weeks /and Units Per Semester</b>		<b>14</b>	<b>28</b>

<b>VI. Teaching strategies of the course:</b>
<ul style="list-style-type: none"> <li>• Lectures</li> <li>• Tutorials</li> <li>• Reports &amp; sheets</li> <li>• Laboratories</li> <li>• Seminars</li> </ul>

<b>VII. Assignments:</b>				
<b>No</b>	<b>Assignments</b>	<b>Aligned CILOs(symbols)</b>	<b>Week Due</b>	<b>Mark</b>
1.	Homework 1	a1,a2,a3,b1,b2,c3,d2,d3	2 <sup>nd</sup>	1
2.	Homework 2	a1,a2,a3,b1,b2,c1,c3,d2,d3	3 <sup>rd</sup>	1
3.	Homework 3	a1,a2,a3,b1,b2,c1,c3,d2,d3	4 <sup>th</sup>	1
4.	Homework 4	a1,a2,a3,b1,b2,c1,c3,d2,d3	5 <sup>th</sup>	1

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5.	Homework 5	a1,a2,a3,b1,b2,c3,d2,d3	6 <sup>th</sup>	1
6.	Homework 6	a1,a2,a3,b1,b2,c3,d2,d3	7 <sup>th</sup>	1
7.	Homework 7	a1,a2,a3,b1,b2,c3,d2,d3	8 <sup>th</sup>	1
8.	Homework 8	a1,a2,a3,b1,b2,c3,d2,d3	9 <sup>th</sup>	1
9.	Homework 9	a1,a2,a3,b1,b2,c3,d2,d3	10 <sup>th</sup>	1
10.	Homework 10	a1,a2,a3,b1,b2,c3,d2,d3	11 <sup>th</sup> -12 <sup>th</sup>	1
11.	Homework 11	a1,a2,a3,b1,b2,c3,d2,d3	13 <sup>th</sup>	0.5
12.	Homework 12	a1,a2,a3,b1,b2,c3,d2,d3	14 <sup>th</sup>	0.5
<b>Total</b>				<b>10</b>

<b>VIII. Schedule of Assessment Tasks for Students During the Semester:</b>				
No.	Assessment Method	Week Due	Mark	Proportion of Final Assessment
1	Homework 1 to Homework 13	2 <sup>nd</sup> to 14 <sup>th</sup>	10	6.67%
2	Lab reports 1- 9	4 <sup>th</sup> to 13 <sup>th</sup>	10	6.67%
3	Quizzes 1, 2, 3	4 <sup>th</sup> , 10 <sup>th</sup> , 13 <sup>th</sup>	10	6.67%
4	Mid-Term Exam	8 <sup>th</sup>	20	13.33%
5	Practical Mid-Term Exam	7 <sup>th</sup>	10	6.67%
6	Practical Final Exam	13 <sup>th</sup>	15	10%
7	Final exam	15 <sup>th</sup>	75	50%
<b>Total</b>			<b>150</b>	<b>100%</b>

<b>IX. Learning Resources:</b>	
<ul style="list-style-type: none"> <li>Written in the following order: (Author - Year of publication – Title – Edition – Place of publication – Publisher).</li> </ul>	
<b>1- Required Textbook(s) (maximum two ).</b>	
	1. Kunwoo Lee, 1999, Principles of CAD/CAM/CAE Systems, Addison Wesley Longman, Inc.
<b>2- Essential References.</b>	
	1. Ibrhim Zeid, 2004, Mastering CAD/CAM, McGraw Hill international. 2. Ibrhim Zeid, "CAD/CAM Theory and Practice", McGraw Hill international. 3. Thomas O. Boucher, 1996, "Computer Automation in Manufacturing an Introduction", Chapman & Hall.

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	<p>4. Tien-Chien Chang, Richard A. Wysk, Hsu-Pin Wang, 2005, “Computer-Aided Manufacturing”, 3<sup>rd</sup> Edition, Prentice Hall.</p> <p>5. P. N. Rao “CAD/CAM principles and operations”, Tata McGraw Hil.</p> <p>6. Groover, M.P., 2015,“Automation, Production Systems and Computer-Integrated Manufacturing”, 4<sup>th</sup> Ed., Prentice-Hall.</p>
<b>3- Electronic Materials and Web Sites etc.</b>	
	-

<b>II. Course Policies:</b>	
<b>1</b>	<p><b>Class Attendance:</b></p> <p>- The student should be attending not less than 75% of total contact hours of the subject, otherwise he will not able to take exam and <b>be considered</b> as <b>an</b> exam failure. If the student is absent due to illness, he/she should bring <b>an approved</b> statement from university Clinic.</p>
<b>2</b>	<p><b>Tardy:</b></p> <p>- For <b>lateness</b> in attending the class, the student will be initially <b>notified</b>. If he <b>repeats</b> late in attending class <b>he will be considered absent</b>.</p>
<b>3</b>	<p><b>Exam Attendance/Punctuality:</b></p> <p>- The student should attend the exam on time. He is <b>permitted</b> to attend the exam half one hour from exam beginning, after that he/she will not <b>be</b> permitted to take exam and he/she <b>is considered</b> absent in <b>the</b> exam.</p>
<b>4</b>	<p><b>Assignments &amp; Projects:</b></p> <p>- In general one assignment is given after each chapter of a course. The student should submit the assignment on time, mostly one week after <b>giving</b> the assignment</p>
<b>5</b>	<p><b>Cheating:</b></p> <p>- For cheating in exam, the student <b>is</b> considered as <b>failure</b>. <b>In case</b> the cheating <b>is</b> repeated three times during study the student will <b>be disengaged</b> from the Faculty</p>
<b>6</b>	<p><b>Plagiarism:</b></p> <p>Plagiarism is the attending of the student the exam of a course instead of other student. If the examination committee <b>proved</b> a plagiarism of a student, he will be disengaged from the Faculty. The final disengagement of the student from the Faculty should be confirmed from the Student <b>Affair Council</b> of the university.</p>
<b>7</b>	<p><b>Other policies:</b></p> <ul style="list-style-type: none"> <li>- The mobile phone is not allowable <b>to be used</b> during class lecture. It must <b>be switched off</b>, otherwise the student will <b>be ordered</b> to leave the lecture room.</li> <li>- The mobile phone is not allowed <b>to be taken during the examination time</b>.</li> <li>- Lecture notes and assignments <b>may be</b> given directly to students using soft or hard copy.</li> </ul>

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