



Engineering Program

Specialization	Industrial Automation
Course Number	20307241
Course Title	Computer-aided Manufacturing
Credit Hours	2
Theoretical Hours	2
Practical Hours	0



Brief Course Description:

- ❖ Introduction to production and manufacturing systems. Metal removal processes. Metal removal machines. Machining parameters of metal removal processes. NC and CNC systems. Structure of NC and CNC systems. Positioning systems in NC and CNC systems. Basic calculations. Accuracy and repeatability. Process planning. NC part programming. ISO coding system. NC programming. G-M codes. Examples of part programming

Course Objectives:

Upon the completion of the course, the student will be able to:

1. Distinguish between production system and manufacturing system.
2. Define geometric models
3. Construct geometric models
4. Identify basic machining processes
5. Calculate machining parameters
6. Prepare NC part program
7. Operate NC and CNC machines



Detailed Course Description:

Unit NO.	Content	Notes	Time Needed
1.	Introduction to Production Systems and Manufacturing Systems	<ul style="list-style-type: none"> Definition of production system and manufacturing system. Elements of production system and manufacturing system. Classification of manufacturing systems. Role of computers and information technology in production systems and manufacturing systems 	
2.	Introduction to Computer-Aided Design CAD	<ul style="list-style-type: none"> Definition of CAD. Modeling process. Types of models. Geometric models. Definition of geometry. Geometric models representation. Geometric models manipulation Transformation operations 	
3.	Machining Processes	<ul style="list-style-type: none"> Classification of machining processes. Turning operation, milling operation, drilling operation, grinding operation. Calculation of machining parameters 	
4.	Introduction to Process Planning	<ul style="list-style-type: none"> Definition of process planning. Manual and computer-aided process planning. Machining instructions. Part programming 	
5.	Introduction to Computer-Aided Manufacturing CAM	<ul style="list-style-type: none"> Definition of CAM. Tools for CAM. Definition of NC, CNC and FMS systems. Structure of NC, CNC and FMS systems. Classification of NC and CNC systems. Performance indicators of NC and CNC systems 	
6.	Key Issues of CNC	<ul style="list-style-type: none"> Coordinate systems. Programming mode (absolute programming and incremental programming). Types of motion (point-to-point, linear motion, circular motion). Measuring units. Compensations (tool 	

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		nose, surface speed, tool offset, tool length). Canned cycles. Subprograms and loops. Macros	
7.	NC Part Programming Languages	<ul style="list-style-type: none"> ISO programming language. Coding formats. Word-address format. G-M codes. Examples. APT programming. Geometric commands. Motion commands. Examples including NC machining on turning machines, drilling machines, milling machines, machining centers 	
8.	Introduction to Computer-Assisted NC Part Programming	<ul style="list-style-type: none"> Applications of CAM software. Editing G-M codes. Use CAM software in design, programming and operating NC systems. Examples 	
9.	Tools and Work Holding Devices	<ul style="list-style-type: none"> Set-up work holding procedures. Jigs and fixtures. Classification and specifications of tools. Automatic tool changer 	
10.	NC Machine Maintenance	<ul style="list-style-type: none"> Routine maintenance. Machine tool diagnostics. Safety rules when working on NC machines 	

Evaluation Strategies:

Exams		Percentage	Date
Exams	First Exam	20%	--/--/----
	Second Exam	20%	--/--/----
	Final Exam	50%	--/--/----
Homework and Projects		10%	
Discussions and lecture Presentations			

Teaching Methodology:

- ❖ Lectures

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Text Books & References:

Textbook:

1. Yusuf Altintas, Manufacturing Automation: Metal Cutting Machines, Machine tool Vibrations, and CNC Design, Cambridge University Press, 2000, ISBN: 0521659736.
2. Ken Evans, Programming of CNC Machines, Industrial Press, 2003, ISBN: 0831131624.

References:

1. William W. Luggen, Introduction to NC/CNC operation, Prentice Hall, 1997, ISBN: 013497140X
2. James V. Valentino, Joseph Goldenberg, Introduction to Computer Numerical Control (CN), Prentice Hall, 1999, ISBN: 0130142964





Engineering Program

Specialization	Industrial Automation
Course Number	20307242
Course Title	Computer-aided Manufacturing Workshop
Credit Hours	1
Theoretical Hours	0
Practical Hours	3



Brief Course Description:

- ❖ A hands-on course in support of the manufacturing automation course. The students access the machine-tools in small groups receiving initially demonstration on the equipment and then under supervision executing the programs they have written. Practical activities should include geometric modeling of different parts using modern CAD software, generation of G-M codes for the required NC part programs and executing the programs on the proper NC machine-tools

Course Objectives:

At the end of this course, students will be able to:

1. Use CAD/CAM software.
2. Write NC part programs
3. Execute NC part programs
4. Operate NC and CNC machine-tools.
5. Set-up NC and CNC machine-tools
6. Calculate machining parameters for certain manufacturing processes.
7. Apply subprograms, loops and macros for efficient NC programming.
8. Carry out routine maintenance of NC and CNC machine-tools



Detailed Course Description:

Unit NO.	Content	Notes	Time Needed
1.	Assignment 1	<ul style="list-style-type: none"> Introduction to CAD. Geometric modeling and model definition 	2 weeks
2.	Assignment 2	<ul style="list-style-type: none"> Familiarization of NC and CNC machine-tools. Structure, applications, specifications, coordinate system and axes 	2 weeks
3.	Assignment 3	<ul style="list-style-type: none"> Interpolation modes. Point-to-point motion, linear motion and circular motion 	1 week
4.	Assignment 4	<ul style="list-style-type: none"> Zero offset. Tool compensation (length and nose) 	1 week
5.	Assignment 5	<ul style="list-style-type: none"> Canned drilling cycles 	1 week
6.	Assignment 6	<ul style="list-style-type: none"> Subprograms and loops 	2 weeks
7.	Assignment 7	<ul style="list-style-type: none"> Canned cycles for roughing, finishing and threading 	1 week
8.	Assignment 8	<ul style="list-style-type: none"> Macros 	1 week
9.	Assignment 9	<ul style="list-style-type: none"> Applications of CAD/CAM software 	2 weeks
10.	Assignment 10	<ul style="list-style-type: none"> Machine-tools maintenance 	1 week

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	Final Exam	50%	--/--/----
Homework and Projects		10%	
Discussions and lecture Presentations			

Teaching Methodology:

- ❖ Laboratory

Text Books & References:

Manuals existing at the workshop and the instructional materials prepared by the instructors



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