

CALIFORNIA STATE UNIVERSITY, CHICO
Department of Mechanical and Mechatronic Engineering and Sustainable Manufacturing
Spring 2023

AMAR 260 – APPLIED ADVANCED MANUFACTURING [3 units]

Prerequisites: AMAR 160 (grade of C- or higher) Recommended: PHYS 202A

Course Time Schedule:

Lecture	Tues, Th 12:30 to 1:45 pm	On-line
Lab 1	Friday 11:00 to 1:50 pm	PLMS 121

Instructor: Harold Koehler

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Office: OCNL 425

Office Phone: 898-5676

Office Hours: T 2-4pm, TH 2-4pm

MMEM Department Phone: 898-5346

Course Objectives:

This course is designed to familiarize the student with the manufacturing processes associated with material removal (mass reduction by chips) and Additive Manufacturing. The focus of this course is on calculating the material removal rate (MRR) when using machine tools, including speeds, feeds, and depth of cut. It includes machine set up and selection of cutting tools along with the responsibilities of a setup machinist and a machine operator. An introduction to manual control of CNC machines is included. The course will also cover Additive Manufacturing. This will include: machines, materials and costs, as well as applications for tooling and production.

Catalog Description:

A study of the industrial applications of material-removal technology. Emphasis will be placed on the management of the application of the technology, including the application of sustainable materials, consumables and power management. Units involving the physics of metal-cutting, cutting-tool materials and geometry, conventional and semi-automatic machine tools, and cost-estimating are included. 2 hours lecture, 3 hours laboratory.

Textbook:

- Technology of Machine Tools, 5th or 6th edition, Krar [REQUIRED]
- 3D Printing – Understanding Additive Manufacturing 2nd Edition, Andreas Gebhardt 2019 [REQUIRED]
- Shop Reference for Students & Apprentices, Second Edition, Christopher McCauley, 2000, Industrial Press Inc. New York Published: June, 2001 ISBN: 9780831130794 [RECOMMENDED]

Costs During Term Of Course:

Safety Glasses: **[REQUIRED]**
Dial or Digital Caliper and 6" steel rule **[REQUIRED]**

Evaluation Procedure:

Laboratory exercises & Journal	35%
Article Reviews	10%
Additive Manufacturing Presentation	15%
Mid-term exam	20%
Final exam.....	<u>20%</u>
Total	100%

Safety Policy & Cell Phones

Everyone in Plumas 121 must wear eye protection and closed-toed shoes at all times. **CELL PHONES MUST BE STORED IN YOUR BACK PACK OR LOCKER IN PLUMAS 116** This is a matter of safety and respect to all those attending the class. Anyone failing to comply with all posted lab safety rules will be told to leave the lab immediately and not be allowed to return to the lab that day. Repeated offenses will result in failing the course.

Dropping and Adding Class

You are responsible for understanding the policies and procedures about add/drops, academic renewal, etc., found in the [CSU Chico University Catalog](#). The last day to add or drop the class without instructor's permission is Friday, February 4, 2022.

University Policies and Resources Academic integrity

Students are expected to be familiar with the University's Academic Integrity Policy. Your own commitment to learning, as evidenced by your enrollment at California State University, Chico, and the University's Academic Integrity Policy requires you to be honest in all your academic course work. Faculty members are required to report all infractions to the Office of Student Judicial Affairs. The policy on academic integrity and other resources related to student conduct can be found on the Student Judicial Affairs web site.

Americans with Disabilities Act

If you need course adaptations or accommodations because of a disability or chronic illness, or if you need to make special arrangements in case the building must be evacuated, please make an appointment with me as soon as possible, or see me during office hours. Please also contact Accessibility Resource Center (ARC) as they are the designated department responsible for approving and coordinating reasonable accommodations and services for students with disabilities. ARC will help you understand your rights and responsibilities under the Americans with Disabilities Act and provide you further assistance with requesting and arranging accommodations.

Accessibility Resource Center

530-898-5959

Student Services Center 170

arcdept@csuchico.edu

Student Learning Center

The mission of the Student Learning Center (SLC) is to provide services that will assist CSU, Chico students to become independent learners. The SLC prepares and supports students in their college course work by offering a variety of programs and resources to meet student needs. The SLC facilitates the academic transition and retention of students from high schools and community colleges by providing study strategy information, content subject tutoring, and supplemental instruction. The SLC is online at <http://www.csuchico.edu/slc>.

Covid Reminder: The CSU requires students to be fully vaccinated against COVID-19 by September 30, 2021, unless you have an approved exemption. Currently, Chico State is requiring everyone on campus to wear an approved face covering in all indoor campus spaces. Accordingly, all students are required to wear an appropriate face mask covering the nose and mouth in order to participate in this course. Policies and requirements regarding COVID-19 are subject to change pursuant to campus, local, state and/or federal guidelines.

Please note that dishonesty relating to the vaccination policy and/or your failure to comply with any other COVID-19 related safety policy or mandate, including the face covering requirement, may result in disciplinary action against you through the office of Student Conduct, Rights and Responsibilities, which can include suspension or expulsion from the California State University system.

Individuals unable to wear a face covering due to a medical condition should contact the Accessibility Resource Center by phone at (530) 898-5959 or by email at arcdept@csuchico.edu .

AMAR 260 – Applied Advanced Manufacturing -- SPRING 2023

WEEK	DATE	PLANNED TOPICS	READING	WORK DUE
1	1/24-27/22	Course introduction: Additive & Subtractive Advanced Manufacturing. The history of machine tools and tool geometry	Units 1 & 30	
	Lab 1	Lab Familiarization and safety review. HSS tools & Carbide Inserts familiarization. Tooling and Tool Holding applications Demo	Unit 37 & Insert Handout	
2	1/31 – 2/3/23	The Physics of Metal Cutting , and Cutting Tool Materials	Units 27-29	
	Lab 2	Drill Bit Grinding & Drilling Demo.		Drill Bit Grinding Exercise & Quiz
3	2/7-10/23	Intro to drilling machines and work holding.	Units 38 - 44	Writing Assignment 1
	Lab 3	Lathe Turning Exercise	Unit 41	Lathe Turning Exercise
4	2/14-17/23	The Lathe, work holding, and machining between centers	Units 45 - 53 & 56	
	Lab 4	Sweeping in Lathe Four Jaw Chuck and turning between centers Demo	Unit 47	Sweep in Four Jaw Chuck Exercise
5	2/21-24/23	Tapers, threads and thread turning. Advanced lathe topics.	Units 54 & 55	
	Lab 5	Sweeping in Milling Machine and Aligning Vise		Sweeping & Aligning Exercise
6	2/28 - 3/23	Milling machines and types of milling cutters.	Units 55 - 58	
	Lab 6	Acme thread and “Wazer” Water jet demonstration	Unit 60	
7	3/7-10/23	Review for Midterm 3/7/23, MIDTERM EXAM 3/9/23		
	Lab 7	First Vise Operation, establishing the datum’s.	Unit 68	First Vise Opp.
8	*** SPRING BREAK *** (March 13th through 17th)			
9	3/21-24/23	Introduction to CNC milling Concepts. Basic G - code functions. EDM & CMM	Units 85 - 89	Writing Assignment 2
	Lab 8	CNC Milling of small vise sliding jaw casting.		Milling CNC
10	3/28-30/23	Introduction and history of additive manufacturing. Binder Jetting and Direct Energy Deposition.		Submit drawing of water jet part
		3/31/23 Cesar Chavez Day – No Lab		
11	4/4-7/23	Additive Manufacturing. Material Extrusion and Material Jetting. Assign Presentation Topics	3D Printing Text Book, Chapter 1	Submit drawing of Additive part
	Lab 9	CNC Milling of small vise casting with program control, adding the slot.		
12	4/11-14/23	Additive Manufacturing. Powdered Bed Fusion and Sheet Lamination.	3D Printing Text Book, Chapter 2	Writing Assignment 3. Chap. 1 Questions
	Lab 10 & 11	Machining Vice Base. Soft Jaw tooling demo. Machining the movable jaw, and drilling/tapping operations.		
13	4/18-21/23	Additive Manufacturing. Vat Photo Polymerization and Inconel Case Study: Additive Prototype, and Advanced Manufacturing	3D Printing Text Book, Chapter 3	Chapter 2 Questions
	Lab 12	High Speed Machining Demo. Additive Tooling Demonstration & SolidWorks for Additive Manufacturing.		
14	4/25-28/23	EDM & CMM	3D Printing Text Book, Chapter 4	Chapter 3 Questions
	Lab 13	CMM Demo and Open Lab		
15	5/2-5/23	Lean Manufacturing	3D Printing Text Book, Chapter 5	Writing Assignment 4, Chap. 4 Questions
	Lab	Open Lab.		Water Jet & Additive part Due
16	5/9-12/23	Presentations, Final Exam review session		Chapter 5 Questions
	Lab	Open Lab, all work due		
17	5/XX/23	FINAL EXAM TBD		

