EGR 218: Materials and Manufacturing Processes, Spring 2022 Session, Class # 14616

3 Credit Hours

Faculty Information	Instructor: Prof. Keng Hsu Office: TBD Phone: TBD
Class Time and Location	Days: Mondays and Wednesdays 15:00 –16:15 Duration: 01/10/2022-4/29/2022 Location: Poly Peralta 135
Office Hours	Thursdays (12:00 to 13:00);
Textbook	**Manufacturing Engineering and Technology, 7th ed., Kalpakjian and Schmid**
Reference Works On reserve at the Center Library	Fundamentals of Modern Manufacturing, 3rd ed., M.P. Groover Binary Alloy Phase Diagrams, Massalski, editor (online access)
Other useful references	Physical Metallurgy Principles, Reed-Hill (any edition) Materials and Engineering-An intro, 6th, Callister CRC Handbook of Chemistry and Physics, any edition
Relevant Software	MS-Word, PowerPoint, Excel
Course Website	myasucourses.asu.edu (CANVAS)
Prerequisites	CHM 113, or CHM 114

EGR 218 - Materials and Manufacturing Processes

Course Description

Applies material properties and manufacturing processes to the design and fabrication of engineered artifacts.

Enrollment requirements

Prerequisite(s): CHM 113 or 114 with C or better OR Visiting University Student

Offered by

Ira A. Fulton Schools of Engineering

Additional Class Details

General Studies: No
Component: Integrated Lecture/Lab
Units: 3
Repeatable for credit: No

Important Deadlines

Last day to enroll: January 16, 2022
Drop deadline: January 16, 2022
Course withdrawal deadline: April 03, 2022

Spring 2022 | Class # 14616

Seats Open: 38 of 60
Fees: None

Days	Dates	Start	End	Location	Instructor
M W	01/10 - 04/29	3:00 PM	4:15 PM	Poly - PRLTA135	Hsu

Add Class

Course Materials

Not yet provided by instructor. Refer to syllabus for additional details.

Catalog Description of EGR 218:
Applies material properties and manufacturing processes to the design and fabrication of engineered artifacts.
Course Objectives:

Materials Classification	Students are able to identify materials of different types and identify the general differences between materials of different types
Materials Selection	Students are able to use Ashby plots and similar to select an appropriate material for a specific design constraint
Materials Properties	Students are able to identify what dictates material properties and identify processes that can alter material properties
Mechanics of Materials	Students are able to conduct basic materials mechanics analysis related to diffusion, stress & strain, heat treatments
Understand Basics of Manufacturing Processes	Students are able to distinguish between various manufacturing processes and describe the working principles of each process
Manufacturing Process Selection	Students are able to select appropriate manufacturing processes for a specific material and design

Course Grading:

Homework:	20 percent	(4 take-home assignments, 5 points each)
Mid-term Exam	20 percent	(20-point exam)
Final Exam	20 percent	(30-point exam)
Manufacturability Project:	20 percent	(10-point team assignment)
In-class participation:	20 percent	(Weekly quizzes, all on Wednesdays)
	100 percent	

Grading Scale (based on the total percentage accumulated): grades maybe curved if appropriate

- 100-90 = (A+ will be given for 95+)/ A for <95
- 89-80 = B+ for 85+/ B for <85
- 79-70 = C+ for 75+/ C for <75
- 69-60 = D
- 59 or below = E

Grade Adjustments. If you believe that there was a grading error and you have written a justification, please bring the graded assignment to your instructor for discussion. Questions or concerns about grading should be presented in a professional manner.

Homework:

- 4 homework assignments, 5 points each.
- Assignments will be posted on the course CANVAS site, in the weeks noted on the class calendar.
- Your homework will be due on the following Wednesday, **ONLINE.** Homework may be handed-in up to one week late- but will receive an automatic 50% penalty.
- Homework will **NOT** be accepted after one week; a "zero" score will be given for missed homework.
- Makeup homework- only with a *really* persuasive reason.
- Unless otherwise specified, we will use the MKS, or "Systeme Internationale" units, *NOT* cgs or US or English measurements.
- All numeric answers in the homework and exams should be presented in standard SI notation, and SI units (meter, kilogram, second, etc.), with the **correct number of significant digits.**
- **Tutoring is available in the Tutoring Center, above the library, northeast side.**

Exams:

- There will be 2 exams, see table below. The final exam will be comprehensive.
- The exams may consist of True/False, short answers, quantitative problems, materials/manufacturing process selection and justification questions.
- You will certify that you did the exams without assistance from other students.
- Makeup exams will be given with a written medical excuse only. No makeup for the final exam.

Manufacturing Team Project:

- Each team will have 3 members.

- Each student tam will carry out a "manufacturability case study" on an ***existing commercial product*** of their choice.
- One student will be selected by the group members as the "Team lead".
- The selected product must have **at least 5 unique parts/components**, not including fasteners (screws, rivets, clips or bolts). Suggestion - do not opt for an overly complex product!
- "Reverse Engineer" your product to the component/sub-assembly level.
- Examples are provided to help guide your developments.
- Textbook Chapters 10-27 can help identify methods and processes. These topics will be addressed in detail in the latter half of the class sequence.
- Find the average selling price for the product in the marketplace- note that this may entail checking several sources- full-price retailers versus cost-cutters versus "overstock" shops.

Students will divide the project activities to cover the following areas and document relevant results from these activities in the final report:

1. Select a commercial product. The product must have at least 5 unique components (not counting fasteners, clips, screws, bolts, etc.)

2. Reverse-Engineer your product to the component level. List the materials of construction for your product.

- Explain why you think these materials were selected by the manufacturer (e.g., cost, ease of manufacture or assembly, ease of shaping, strength, stability, weather resistance, wear resistance, maintenance/repair, etc.).

*Make an Excel table, "Components", listing each component, material, coating or plating, OEM reasons for selection, and the fasteners used (**NOT** in the parts count…)*

3. Create a list of all of the manufacturing methods and tools/processes necessary to create the product.

- For each component, consider the possible methods for producing the part, and the associated tools or equipment (there may be several options for each component).
- For each component, consider the possible methods and tooling for coating/plating/protecting the part in its intended use or application (there may be several options for each component).

Make an Excel table, "Manufacturing Methods", listing each part, part descriptions and materials, and all of the manufacturing processes needed to make each part, and reasons for selection of the process step or tooling/equipment.

4. Create a complete process flow sequence for each component in your product.

*Make an Excel table, "Process Flows", for each part and material, and coating processes. Describe **all** of the process steps needed for each component.*

5. Create a complete listing of ALTERNATIVE materials, processes, tools and flow sequence for each component in your product.

Make an Excel table, "Alternate Matls and Processes", for each part and material, and coating processes. For each component document your reasoning and trade-offs

6. **Create a complete assembly sequence for your product**. Consider series, parallel and series/parallel assembly flows. Comment on the speed of assembly (your estimates, units per unit time) using different flows and manufacturing methods.

7. **Create an DFA analysis based on the B&D method described in the lectures/discussions**.

The Project will be graded based on:

- Team member's contributions– each student is responsible for working on at least two item (1-7) in the above list. Note that group efforts will be most effective for each item, but one person acts as the "lead" in the topic.
- The team leader must submit a file through CANVAS in your group files area that includes the names of the team members, the NAME OF THE TEAM, the selected product, and each individual's responsibility. 5% of the project score, **due date see the timeline table on page 6**.
- A mid-semester **5-minute** progress report presentation- the team leader will provide a **1 minute** PowerPoint overview, and each team member will give a short PowerPoint summary of their activities- 2 minutes each maximum, covering items 1-3. 25% of the project score. **To be presented and critiqued (due date see the timeline table on page 6)**. The presentation file will be placed in the CANVAS group file site by the end of the day, **due date see the timeline table on page 6**.
- The FINAL project presentation will follow the same procedure– each team has **10 minutes** for presentation. The team leader will provide a **2 minute** PowerPoint overview, and each team member will give a short PowerPoint summary of their activities- 4 minutes each maximum. 50% of project score, **to be presented and critiqued (due date see the timeline table on page 6)**. The final presentation must include the results of items 4 through 7, as noted above. The presentation file will be placed in the CANVAS site by the end of the day, **due date see the timeline table on page 6**.

- One project final report per team, 20% of the project score, **due date see the timeline table on page 6, to be submitted through CANVAS by the team leader and each member of the team. The report must include the following:**

- **General Information: Project Title, Team member's names, and in what area is each team member serving as a lead in the project,**
- **Product analyses documentation, supporting data, assumptions for each major topic or item in the list above**
- **B&D DFA Results and comments**
- **Concluding statement on:**
  - **The manufacturing process and cost of manufacturing;**
  - **Materials and cost of materials;**
  - **Answer the question: "Could we bring this product to market"- your opinions, not just yes or no.**

Expectations for EGR 218 Students:

- You must submit your own individual work for all assignments and the exams. The only exception is the team manufacturability project.
- ***Academic dishonesty in any form, cheating, plagiarism, copying, etc., will result in a grade of E.***
- **Attend class.** The presentation and discussions in class cover topics in-depth and scope beyond the textbook. This is a vital part of understanding the materials in the course. Many illustrative sidebars and other information will be presented. Pop quizzes will be given from time to time.
- **Read the class textbook.** Reading the assigned materials will greatly help you understand the topics discussed in class. Investigate other resources, the libraries, and reference works.
- **TAKE NOTES-** experience showed this was important! Use of your laptops for taking notes or for class activities is permitted. ***However, Facebook, Twitter, email, texting, video games, web surfing, etc., are NOT appropriate class time activities.***
- **Participate in class**. Come prepared to learn, actively participate in individual and group activities and discussions. Ask questions at any time.
- **Internet-** The internet provides an easy method to find information, but the veracity and accuracy are not always confirmed; *be careful!*
- **Actively participate** as a team member on the team project.
- **Study and preparation time-** you should plan on spending 2 to 3 hours per week outside of class for each course credit hour (i.e., 6 to 9 hours per week for this class) to get the most out of this course. If something is interfering with your success in this course, please see me as soon as possible. I am happy to help you with any questions or problem areas.
- **Absences** will only be accepted in the following circumstances:
- Prior notification to the instructor, and with the instructor's written approval. Email is appropriate.
- Documented illness, injury or other reasonable, valid emergency, and with the approval of the instructor.
- Absences due to religious observances/practices (in accord with ACD 304–04, "Accommodation for Religious Practices"), or, as related to university-sanctioned events or activities (in accord with ACD 304–02, "Missed Classes Due to University-Sanctioned Activities") will be accommodated. At least one week advance notice to the professor is required.
- **Check your ASU email often.** I will communicate with you at your ASU email address. You are expected to be aware of these communications. I expect all email communication to be done in a professional manner. Use an appropriate subject line description, an appropriate greeting, professional language, tone and correct grammar, and sign your name. These guidelines pertain to all homework assignments and in-class presentations, in-class discussions, and ASU e-mail correspondence.
- **Check your CANVAS every day!**
- Other Important Information:

Students with disabilities- The Americans with Disabilities Act (ADA) provides comprehensive civil rights protection for persons with disabilities. This legislation requires that all qualified students with documented disabilities be guaranteed a learning environment that provides for reasonable accommodation of their disabilities. If you believe you have a disability requiring an accommodation please contact the Disability Resource Center at ASU Polytechnic located in Sutton Hall, Suite 240, or call 480-727-1039 / TTY: 480-727-1009. Policies regarding eligibility and documentation are available online at: http://www.asu.edu/studentaffairs/ed/drc/ . Any students who have special needs or accommodations for this course are encouraged to communicate with me as soon as possible to make appropriate arrangements.

Sexual Discrimination- Title IX is a federal law that provides that no person be excluded on the basis of sex from participation in, be denied benefits of, or be subjected to discrimination under any education program or activity. Both Title IX and university policy make clear that sexual violence and harassment based on sex is prohibited. An individual who believes they have been subjected to sexual violence or harassed on the basis of sex can seek support, including counseling and academic support, from

the university. If you or someone you know has been harassed on the basis of sex or sexually assaulted, you can find information and resources at https://sexualviolenceprevention.asu.edu/faqs.
As a mandated reporter, I am obligated to report any information I become aware of regarding alleged acts of sexual discrimination, including sexual violence and dating violence. ASU Counseling Services, https://eoss.asu.edu/counseling is available if you wish to discuss any concerns confidentially and privately. ASU online students may access 360 Life Services, https://goto.asuonline.asu.edu/success/online-resources.html.

The ASU Face Cover Policy (https://www.asu.edu/about/fall-2021#face-coverings) requires the wearing of face covers in the majority of classrooms, teaching laboratories, studios and workshop settings. The space for this class has been designated as a space requiring face covers. Please wear a face covering over your nose and mouth at all times during class for the health and safety of yourself and others.

On-Campus Resources:
There are many resources on campus to help you achieve personal and academic success:

- Writing centers – http://studentsuccess.asu.edu/writingcenters
- Tutoring, student success centers: http://studentsuccess.asu.edu
- Counseling / consultation: http://students.asu.edu/counselingpoly
- Career preparation center: http://students.asu.edu/career/poly
- Libraries: http://libguides.asu.edu

Academic Conduct & Responsibility:

- Each student has an obligation to act with honesty and integrity, and to respect the rights of others in carrying out all academic assignments. In EGR 218, **any student who is found to have violated the academic integrity policy will, as a minimum, receive an E in the course**.

Policies:

- Academic Integrity Policy: https://provost.asu.edu/academicintegrity/students
- Students are expected to execute all course assignments and activities in accordance with the University's Student Academic Integrity Policy. Detailed information on the policy can be found at https://provost.asu.edu/index.php?q=academicintegrity
- Student Code of Conduct: https://students.asu.edu/srr , http://www.asu.edu/studentlife/judicial/

Students are expected to participate in the educational process and not be a disruptive element with regard to the learning of others. Safety, self-discipline and respect for others are necessary elements in the educational processes employed in this course.

Week	Date	Class Activities/Reading Assignments	HW	Quiz	Project	Exam
1	1/10 - 1/14	Course overview Reading: Kalpakjian Ch1				
2	1/17 - 1/21	Monday Off: MLK J. Holiday Atomic Structures & Bonding; Crystal Structure; Defects Reading: Kalpakjian Ch2, Ch3		Q1	Team Info	
3	1/24 - 1/28	Mechanical Properties; Dislocation & Strengthening Reading: Kalpakjian Ch4		Q2		
4	1/31 - 2/4	Ferrous and Nonferrous Metals; Reading: Kalpakjian Ch5, Ch6	HW1	Q3		
5	2/7 - 2/11	Diffusion; Phase Diagrams Reading: Kalpakjian Ch7		Q4		
6	2/14 - 2/18	Polymers & Polymer Processing Reading: Kalpakjian Ch8, Ch19		Q5		
7	2/21 - 2/25	Carbon & Composite Processing; Ceramics & Processing Reading: Kalpakjian Ch9, Ch19	HW2	Q6		
8	2/28 - 3/4	Mid-term Project Presentation; Mid-term exam			Mid-term Presentation	Mid-term
9	3/7 - 3/11	Spring Break				
10	3/14 - 3/18	Assembly&DFA Reading: Kalpakjian Ch21, Ch22, Ch23	HW3	Q7		
11	3/21 - 3/25	Machining Processes Reading: Kalpakjian Ch24, Ch25		Q8		
12	3/28 - 4/1	Casting Fundamentals and Processes Reading: Kalpakjian Ch10, Ch11, Ch12		Q9		
13	4/4 - 4/8	Forming Fundamentals and Processes Reading: Kalpakjian Ch13, Ch14, Ch15, Ch16	HW4	Q10		
14	4/11 - 4/15	Joining Processes; Non-traditional Processes Reading: Kalpakjian Ch30, Ch31, Ch32, Ch26, Ch27		Q11		
15	4/18 - 4/22	Metrology; Additive Manufacturing Reading: Ch20, Ch35		Q12		
16	4/25 - 4/29	Project Presentations			Final Presentation	
	5/2-5/9	Final Exam week			Project Report	Final Exam

- All HWs will be posted/assigned online and only online submissions are acceptable (makeup will be exceptions).
- Students registered with the ASU Disability Resource Center (DRC) will be given extra time (discuss this with the instructor) and listed in a separate slack channel