San José State University
Aviation and Technology Department
Tech 25, Introduction to Materials Technology, Section 01/11/12, Spring, 2019

Course and Contact Information

Instructor:	Dr. David P. Yan
Office Location:	IS 101
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Email:	david.yan@sjsu.edu
Office Hours:	Thursday: 10:00AM - 12:00 PM; (and by Arrangement)
Class Days/Time:	Wednesday: 9:00AM - 11:45 AM (Laboratory, Section 12) Thursday: 1:30PM – 4:15 PM (Laboratory, Section 11) Thursday: 6:00 PM – 7:45 PM (Lecture, Section 01)
Classroom:	E103 for lecture and E105 for lab activities
Prerequisites:	Math 008 or equivalent; Corequisites: Chem 001A or 030A or equivalent

Course Description

Designed to introduce students to materials used to make consumer and commercial products. Including metals, plastics, and composites. How materials impact our lives and standard of living. Materials selection and the role of experimentation, testing and evaluation procedures.

Course Learning Outcomes (CLO)

Upon successful completion of this course, students will be able to:

1. List the fundamental material types and describe chemical bonding, basic characteristics and applications of each
2. Describe the basic crystalline structure and both qualitatively and quantitatively estimate physical properties of crystalline materials
3. Describe point, linear, and planar defects in crystalline materials and how these effects on mechanical behavior
4. Estimate diffusion rates in solids in steady state operation
5. Quantitatively describe mechanical responses of materials to tensile and shear stresses and describe material properties such as hardness and toughness, as a result of responses to applied stresses
6. Describe different methods used in heat treatment of materials and what properties are altered by each method
7. Describe mechanisms for failure in materials, both fatigue and fracture, quantitatively characterize each as a function of defects, and describe ways to reduce failure
8. Analyze and apply phase diagrams for binary systems to characterize alloys and predict solid state microstructures

9. Describe different metal alloys and their properties and recommend the optimal material for specific applications
10. List the basic components of ceramics and characterize mechanical behavior of common ceramics
11. Describe basic polymer families, how polymers are formed, and resulting physical, chemical, and mechanical properties
12. Describe both particle reinforced and fiber reinforced composites, give application of both, and estimate physical properties based on fiber alignment
13. Describe mechanisms of corrosion, estimate corrosion rates, and describe corrosion prevention methods
14. Explain how semi-conductor materials are used to generate electricity

Required Texts/Readings

Textbook

1. William D. Callister & David G. Rethwisch, "Materials Science and Engineering: An Introduction", 9th Edition, Wiley, John & Sons, Incorporated, ISBN: 9781118477700. eBook, available at Spartan Book Store

The lab handouts are available on the Canvas (lab section 11/12). Please print the lab materials and read them thoroughly before each lab meeting.

Course Requirements and Assignments

1. Assignments (20%)
Assignments will be given approximately bi weekly throughout the semester, and late assignments submissions will be accepted at the standard penalty of -20% per day late, cumulative.

2. Quizzes (10%)
Quizzes will be held randomly throughout the semester in both lecture and lab section and last for 30 minutes. These will not be announced beforehand. If missed, there is no makeup or recourse. Their objectives are to work problems regularly and reward lecture and lab attendance.

3. Mid-Term Exam (15%)
One midterm exams of 60 minutes duration will be held on **March 28 from 6:00PM-7:00PM**, covering all the topics discussed in the class and previous assignments. More information will be provided about this exam.

4. Lab Activity and Report (15%)
Lab activities are an integral part of this course and include experiments, tutorials, demonstrations and workshops. Lab work will be done in group of 3 to 5 students and your active participation is required. See respective lab handouts for the description, parameters, and constraints for each lab.

A written lab report for each lab team will be due at the beginning of each lab period as detailed in the attached lab schedule. Only reports that are prepared on a word processor will be accepted and late report submissions will be accepted at the standard penalty of -20% per day late, cumulative. For guidance in writing lab reports, consult the beginning material in the lab handouts. Also, SJSU has an excellent writing center. You can make an appointment to go over your lab report with a writing tutor. They also offer workshops and other resources to improve your writing.

5. Term Project (10%)
Term project will be done in groups of 3 to 5 students, as much as possible from different majors. Each team should choose one topic from the list below:

1). Titanic Disaster
2). Chernobyl Disaster
3). Space Shuttle Columbia Disaster

The purpose of the project is to give students an opportunity to study materials failure analysis in engineering disasters and experience in working in a team environment. To ensure timely progress in the project, there will be an oral term project review in mid semester. A final project presentation and a written report for each project team will be due at the end of the semester. The project work needs to focus on the analysis of engineering design or materials failure and the impact of engineering technology solutions in a societal and global context. The required aspects of the term project include:
• Materials failure analysis etc.
• Oral communications
• Written communications

"Success in this course is based on the expectation that students will spend, for each unit of credit, a minimum of 45 hours over the length of the course (normally three hours per unit per week) for instruction, preparation/studying, or course related activities, including but not limited to internships, labs, and clinical practica. Other course structures will have equivalent workload expectations as described in the syllabus."

Final Examination or Evaluation

6. Final Exam (30%)
The final exam will be scheduled by the university on **Thursday, May 16 from 17:15-19:30**. Also see the following links http://info.sjsu.edu/static/catalog/final-exam-schedule-spring.html The final exam will be comprehensive. More information will be provided about this exam.

Grading Information

Your grade will be based on your performances in the assignments, quizzes, mid-term exam, lab activity & reports, term project and final exam. The following items and percentages are used to determine your course grade:

Item	Number of items evaluated	Total Percentage
Assignments	4 to 6	20
Quizzes	2 to 4	10
Mid-Term Exam	1	15
Lab Activity and Report	3 to 5	15
Term Project	1	10
Final Exam	1	30
Total		100

Determination of Grades

Grade	Percentage
A plus	96 to 100%
A	93 to 95%
A minus	90 to 92%
B plus	86 to 89 %
B	83 to 85%
B minus	80 to 82%

Grade	Percentage
C plus	76 to 79%
C	73 to 75%
C minus	70 to 72%
D plus	66 to 69%
D	63 to 65%
D minus	60 to 62%

Classroom Protocol

Team work and class participation are an integral part of the learning philosophy. Your ability to participate in class, function as a team member, and to identify and carry out work as part of your team, will form a significant part of your grade. Anonymous peer evaluations are used to assist the instructor in assessing your performance in team work. Take individual and team work seriously, and communicate often, professionally, and effectively with your team mates.

University Policies

Per University Policy S16-9, relevant information to all courses, such as academic integrity, accommodations, dropping and adding, consent for recording of class, etc. is available on Office of Graduate and Undergraduate Programs' Syllabus Information web page at http://www.sjsu.edu/gup/syllabusinfo/"

Tech 25-01 / Introduction to Materials Technology, Spring 2019, Course Schedule

(Schedule is subject to change with notice)

Course Schedule

Week	Date	Topics (lecture contents)	Readings, Assignments, Deadlines
1	Jan. 24 (Thursday)	1. Orientation to the class 2. Discuss on course goals, logistics, grading, expectations, syllabus, assignments, term project and laboratory exercises etc. 3. Lab team formation	All readings are from the required texts: 1). William D. Callister & David G. Rethwisch, "Materials Science and Engineering: An Introduction", 9th Edition, Wiley, eBook 2). Outside materials provided in class
2	Jan 31	1. Atomic Structure & Interatomic Bonding 2. Structure of Crystalline Solids	1). Textbook Ch. 2.1-2.4 & Ch. 2.6-2.9 2). Textbook Ch. 3.1-3.10 & Ch. 3.12
3	Feb. 7	1. Crystalline and Noncrystalline Materials 2. Imperfections in Solids 3. Assignment 1	1). Textbook Ch. 3.13-3.15 & Ch. 3.17 2). Textbook Ch. 4.1-4.4 & Ch. 4.6-4.8
4	Feb. 14	1. Diffusion 2. Mechanical Properties of Metals I	1). Textbook Ch. 5.1-5.7 2). Textbook Ch. 6.1-6.6 3). **Assignment 1** Due
5	Feb. 21	1. Mechanical Properties of Metals II 2. Dislocations & Strengthening Mechanisms I	1). Textbook Ch. 6.7-6.12 2). Textbook Ch. 4.5 & Ch. 7.1-7.4 & Ch. 7.6
6	Feb. 28	1. Dislocations & Strengthening Mechanisms II 2. Failure I 3. Assignment 2	1). Textbook Ch. 7.8-7.13 & Ch. 11.9 2). Textbook Ch. 8.1-8.6 & Ch. 12.8 & Ch. 15.5
7	Mar. 7	1. Failure II 2. Phase Diagrams I	1). Textbook Ch. 8.7-8.15 & Ch. 15.4 2). Textbook Ch. 9.1-9.4 & Ch. 9.6-9.11 3) **Assignment 2** Due
8	Mar. 14	1. Phase Diagrams II 2. Phase Transformation I	1). Textbook Ch. 9.13-9.15 & Ch. 9.18-9.19 2). Textbook Ch. 10.1-10.6
9	Mar. 21	1. Phase Transformation II 2. Application and Processing of Metal I 3. Review for Midterm Exam 4. 3. Assignment 3	1). Textbook Ch. 10.7-10.9 & Ch. 12.11 2). Textbook Ch. 11.1-11.3
10	Mar. 28	**Midterm Exam**	**18:00 – 19:00**

Week	Date	Topics (lecture contents)	Readings, Assignments, Deadlines
11	Apr. 4	SPRING BREAK (NO CLASSES)	
12	Apr. 11	1. Application and Processing of Metal II 2. Structure and Properties of Ceramics	1). Textbook Ch. 11. 7-11.9 2). Textbook Ch. 12.1-12.2 & Ch.12.5-12.6 & Ch. 12.9 3) **Assignment 3** Due
13	Apr. 18	1. Application and Processing of Ceramics 2. Polymer Structure	1). Textbook Ch. 13. 1-13.9 2). Textbook Ch. 14.1-14.7 & Ch.14.9-14.14
14	Apr. 25	1. Characteristics, Application, and Processing of Polymer 2. Composites 3. 3. Assignment 4	1). Textbook Ch. 15.1-15.3 & Ch. 15.7-15.9 & Ch. 15.15-15.19 2). Textbook Ch. 16.1-16.3 & Ch.16.9 & Ch. 16.13
15	May 2	1. Corrosion and Degradation of Materials 2. Electrical Properties	1). Textbook Ch. 17.1-17.3 & Ch.17.5-17.13 2). Textbook Ch. 18.1–18.15 3) **Assignment 4** Due
16	May 9	1. Last Day of Instruction is May 13 2. Review for Final Exam	
17	May 16	**Final exam is on Thursday, May 16**	**17:15-19:30**

Tech 25-11 / Introduction to Materials Technology, Spring 2019, Course Schedule

(Schedule is subject to change with notice)

Course Schedule

Week	Date	Topics (lecture contents)	Readings, Worksheet/Lab reports, Deadlines
1	Jan. 24 (Thursday)	(NO LAB THIS WEEK)	All readings are from the required texts: 1. Lab Handouts 2. William D. Callister & David G. Rethwisch, "Materials Science and Engineering: An Introduction", 9th Edition, Wiley, eBook
2	Jan 31	1. Orientation to the class 2. Discuss on lab safety, goals, logistics, grading, syllabus, term project etc. 3. Lab team formation	
3	Feb. 7	1. Lab 1: Crystal Structures I- Basic Crystal Structures 2. Lab 1 Worksheet 1 & 2	1). Lab Handouts #1 2). Textbook Ch. 3.1-3.7
4	Feb. 14	1. Lab 2: Crystal Structure II- Planes, Directions, & Defects 2. Lab 2 Worksheet 1 to 3 3. Term Project	1). Lab Handouts #2 2). Textbook Ch. 3.8-3.10 3). Lab 1 Worksheet 1 & 2 Due
5	Feb. 21	1. Lab 3: Crystal Structure III- Tensile Tests 2. Lab 3 Worksheet 1 3. Lab Report #1- Tensile Tests	1). Lab Handouts #3 2). Textbook Ch. 3.8-3.10 3). Lab 2 Worksheet 1 to 3 Due
6	Feb. 28	1. Lab 4: Least Squares Regression- Introduction 2. The Least Squares Regression Using MS – Excel	1). Lab Handouts #4 2) Lab 3 Worksheet 1 Due
7	Mar. 7	1. Lab 5: Cold Working of Brass 2. Lab 5 Worksheet 1 3. Lab Report #2- Cold Working of Brass	1). Lab Handouts #5 2). Textbook Ch. 6.7 & Ch. 7.10 3). Lab Report #1- Tensile Tests Due
8	Mar. 14	1. Lab 6: Heat Treatment of Cold Worked Brass 2. Lab 6 Worksheet 1	1). Lab Handouts #6 2). Textbook Ch. 6.7 & Ch. 7.10 3) Lab 5 Worksheet 1 Due
9	Mar. 21	1. Lab 7: Product Life Cycle Analysis 2. Product Life Cycle Analysis Assignment	1). Lab Handouts #7 2). Textbook Ch. 22 3) Lab 6 Worksheet 1 Due 3). Lab Report #2- Cold Working of Brass Due
10	Mar. 28	Term Project Mid-Semester Evaluation	1). Product Life Cycle Analysis Assignment Due

Week	Date	Topics (lecture contents)	Readings, Worksheet/Lab reports, Deadlines
11	Apr. 4	SPRING BREAK (NO CLASSES)	
12	Apr. 11	1. Lab 8: Impact Tests 2. Lab 8 Worksheet 1 3. Lab Report #3- Impact Tests	1). Lab Handouts #8 2). Textbook Ch. 8.6
13	Apr. 18	1. Lab 9: Phase Diagram and Cooling Curves 2. Lab 9 Worksheet 1 to 3	1). Lab Handouts #9 2). Textbook Ch. 9.1-9.12 3) Lab 8 Worksheet 1 Due
14	Apr. 25	1. Lab 10: Temperature Dependence of Conductivity in Metals 2. Lab 10 Worksheet 1 & 2	1). Lab Handouts #10 2). Textbook Ch. 18.1-18.9 3) Lab 9 Worksheet 1 to 3 Due 4) Lab Report #3- Impact Tests Due
15	May 2	1. Lab 11: Temperature Dependence of Conductivity in Semiconductors 2. Lab 11 Worksheet 1 & 2	1). Lab Handouts #11 2). Textbook Ch. 18.1-18.13 3) Lab 10 Worksheet 1 & 2 Due
16	May 9	1. Last Day of Instruction is on May 13 2. Term Project Presentation 3. Lab Clean-Up	1) Lab 11 Worksheet 1 & 2 Due 2) Term Project Report Due

Tech 25-12 / Introduction to Materials Technology, Spring 2019, Course Schedule

(Schedule is subject to change with notice)

Course Schedule

Week	Date	Topics (lecture contents)	Readings, Worksheet/Lab reports, Deadlines
1	The 1st day of Instruction on Jan. 24 (Thursday)	(NO LAB THIS WEEK)	All readings are from the required texts: 1. Lab Handouts 2. William D. Callister & David G. Rethwisch, "Materials Science and Engineering: An Introduction", 9th Edition, Wiley, eBook
2	Jan 30	1. Orientation to the class 2. Discuss on lab safety, goals, logistics, grading, syllabus, term project etc. 3. Lab team formation	
3	Feb. 6	1. Lab 1: Crystal Structures I- Basic Crystal Structures 2. Lab 1 Worksheet 1 & 2	1). Lab Handouts #1 2). Textbook Ch. 3.1-3.7
4	Feb. 13	1. Lab 2: Crystal Structure II- Planes, Directions, & Defects 2. Lab 2 Worksheet 1 to 3 3. Term Project	1). Lab Handouts #2 2). Textbook Ch. 3.8-3.10 3). Lab 1 Worksheet 1 & 2 Due
5	Feb. 20	1. Lab 3: Crystal Structure III- Tensile Tests 2. Lab 3 Worksheet 1 3. Lab Report #1- Tensile Tests	1). Lab Handouts #3 2). Textbook Ch. 3.8-3.10 3). Lab 2 Worksheet 1 to 3 Due
6	Feb. 27	1. Lab 4: Least Squares Regression- Introduction 2. The Least Squares Regression Using MS – Excel	1). Lab Handouts #4 2) Lab 3 Worksheet 1 Due
7	Mar. 6	1. Lab 5: Cold Working of Brass 2. Lab 5 Worksheet 1 3. Lab Report #2- Cold Working of Brass	1). Lab Handouts #5 2). Textbook Ch. 6.7 & Ch. 7.10 3). Lab Report #1- Tensile Tests Due
8	Mar. 13	1. Lab 6: Heat Treatment of Cold Worked Brass 2. Lab 6 Worksheet 1	1). Lab Handouts #6 2). Textbook Ch. 6.7 & Ch. 7.10 3) Lab 5 Worksheet 1 Due
9	Mar. 20	1. Lab 7: Product Life Cycle Analysis 2. Product Life Cycle Analysis Assignment	1). Lab Handouts #7 2). Textbook Ch. 22 3) Lab 6 Worksheet 1 Due 3). Lab Report #2- Cold Working of Brass Due
10	Mar. 27	Term Project Mid-Semester Evaluation	1). Product Life Cycle Analysis Assignment Due

Week	Date	Topics (lecture contents)	Readings, Worksheet/Lab reports, Deadlines
11	Apr. 3	SPRING BREAK (NO CLASSES)	
12	Apr. 10	1. Lab 8: Impact Tests 2. Lab 8 Worksheet 1 3. Lab Report #3- Impact Tests	1). Lab Handouts #8 2). Textbook Ch. 8.6
13	Apr. 17	1. Lab 9: Phase Diagram and Cooling Curves 2. Lab 9 Worksheet 1 to 3	1). Lab Handouts #9 2). Textbook Ch. 9.1-9.12 3) Lab 8 Worksheet 1 Due
14	Apr. 24	1. Lab 10: Temperature Dependence of Conductivity in Metals 2. Lab 10 Worksheet 1 & 2	1). Lab Handouts #10 2). Textbook Ch. 18.1-18.9 3) Lab 9 Worksheet 1 to 3 Due 4) Lab Report #3- Impact Tests Due
15	May 1	1. Lab 11: Temperature Dependence of Conductivity in Semiconductors 2. Lab 11 Worksheet 1 & 2	1). Lab Handouts #11 2). Textbook Ch. 18.1-18.13 3) Lab 10 Worksheet 1 & 2 Due
16	May 8	1. Last Day of Instruction is on May 13 2. Term Project Presentation 3. Lab Clean-Up	1) Lab 11 Worksheet 1 & 2 Due 2) Term Project Report Due