College of Engineering
Course Title: Materials Science **Fall 2020**

Course Prefix: CHEG	Course No.: 2013	Section No.: P01	Department of Chemical Engineering

Instructor Name:	Keisha Antoine, PhD, PE	Prairie View A&M University
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Office Hours: MW 12:30-1:50 PM & 4:00-5:00 PM; F 12:30-2:30 PM
Virtual Office Hours: By Appointment
Course Location: New Electrical Engineering Bldg 115
Class Meeting Days & Times: MWF 11:00-11:50 AM

Catalog Description
(3 -0) Credit 3 semester hours. Chemical bonding, atomic order and disorder, transport properties, single phase and multiphase materials, heat treatment, corrosion, and composites.

Pre-requisites: CHEM 1043 or CHEM 1034 (minimum grades of C; minimum GPA of 2.50)
Co-requistes: NA

Required Text
1. Materials Science and Engineering, An Introduction, 10th Edition or later, William D. Callister, Jr., David G. Rethwisch, Wiley, ISBN-13 9781119321590

Recommended Text/Readings
"The Science & Engineering of Materials", 4th Edition, Donald R. Askeland, Pradeep P. Phulé, Thomson, Brooks/Cole ISBN 0-534-95373-5
Access to Learning Resources:
PVAMU Library
phone: (936) 261-1500
web: http://www.tamu.edu/pvamu/library/

University Bookstore
phone: (936) 261-1990
web: https://www.bkstr.com/Home/10001-10734-1?demoKey=d

Expected Knowledge and Skills In
- General chemistry
- General physics
- Algebra, calculus & differential equations
- Thermodynamics
- Computer Literacy (including spreadsheet proficiency)

Expected Knowledge and Skills Out
- An understanding of the atomic structure of the major classes of materials (metals, polymers, ceramics).
- An awareness of the fundamental properties of materials, their dependence on atomic structure, the manner in which properties are determined, and the manner in which these properties characterize material performance.
- An understanding of the way that processing affects material structure and properties
- Familiarity with the synthesis and key properties of advanced materials (composites)
- An understanding of material deterioration and failure processes.
- An appreciation of the factors affecting material selection

Expected Outcomes

The course is designed to give undergraduate student a fundamental grasp of the molecular, physical and engineering properties of materials in general. The course emphasizes commonalities among the different material classes, viz., metals, ceramics and polymers. Composite materials are also expected to be understood as a mixture of, e.g., polymer and ceramic fiber. Material degradation including corrosion, fatigue and fracture should be understood.

Course Outcome D1.1: This outcome is the same as program outcome a. Ability to apply knowledge of mathematics, science and engineering.

The student is able to demonstrate knowledge and ability to apply (i) chemistry/biology, and (ii) physics in engineering

1. Be able to classify materials (a) according to the five main categories used by practicing engineers, (b) based on function, and (c) based on structure.
2. Be able to present the tetrahedron of material science and engineering and apply it to engineering materials.
3. Be able to write the electronic configuration of an element and relate it to the properties of the element.
4. Be able to state the five different levels the structure of materials may be examined and described, and the importance of nano -scale materials.
5. Be able to identify the types of defects in crystal structures.
6. Be able to state the principles of diffusion, the mechanisms of diffusion and factors that drive diffusion

Course Outcome D1.2: This outcome is the same as program outcome e. Students will have the ability to identify, formulate, and solve fundamental engineering problems.

1. Be able to differentiate tensile, compressive and shear stress.
2. Be able to obtain from a stress-strain diagram the Young's modulus, the yield strength and tensile strength
3. Be able to draw phase diagrams and state the information that is provided.
4. Be able to identify in a phase diagram which phases are present and the solidus and liquidus lines
5. Be able to use a tie line to determine composition of each phase in a binary phase diagram
6. Be able to state the reasons for thermal processing of materials
7. Be able to explain the heat treatments annealing, quenching, austenitizing and normalizing
8. Be able to define corrosion in materials and safety rules followed in materials
9. Be able to give examples of composites and their engineering applications.

Assessment Methodology

Students will be evaluated based on their performance on class examinations, homework, projects, quizzes and the final exam. The internal department criterion D1 – An ability to identify, formulate, and solve fundamental engineering problems by applying principles of engineering, science, and mathematics – will be measured for this course.

Topics To Be Covered

- Atomic structure and interatomic bonding
- Structure of crystalline solids: metals, ceramics, polymers
- Imperfections in crystalline solids
- Diffusion
- Mechanical Properties of Materials
- Failure and fracture
- Phase transformations in materials: metals
- Phase diagram
- Composite materials
- Degradation of materials (safety)
- Thermal properties of materials

Preparation for Class
The students are expected to spend approximately two hours in preparation for each hour of lecture.

Homework Policy
- Homework problems will be solely for practice to get students ready for the class quizzes and tests.
- Practice problems have been provided for students on the tentative lecture schedule. These problems are for your independent practice and not for weekly submission.
- Specific homework assignments will be given throughout the semester as the instructor examines the specific need of the class.
- These assignments may be computer based or involve the textbook.
- Students must submit these assignments during a given time frame.
- If a student chooses to disobey the university's honor code and copy the solution manual instead of submitting the student's own independent work, the student will receive a grade of zero on the assignment and will be referred to the department head. Such meetings must take place within a week of the infraction.

Exam Policy
There are three in-term and one comprehensive final exam for the course. The exams are closed book and closed notes. Examinations will consist of multiple choice and worked-out solution to problems. Students will be able to use handheld calculators in exams. The final exam will not be returned.
- Exams should be taken as scheduled. No makeup examinations will be allowed except under documented emergencies (See Student Handbook).
- No electronic device with internet or network connectivity will be allowed (e.g., smartphones, iPads, eReaders, Tablets, etc.)
- No graphing calculators are allowed for any test or quiz. Students must purchase a small scientific calculator to use on exams. A cell phone cannot be use as a replacement for a graphing calculator on an exam.
- Students should dress professionally and are NOT allowed to wear caps/hats in class.
- Students are NOT allowed to bring food to the classroom or eat in class.
- Any sightings of a cellular phone during an exam or a quiz will automatically result in a grade of zero for that student, and the student will be referred to the department head. Such meetings must take place within a week of the violation.

Grading System

Item (Averages)	Weight %		Grade	Percentages
Attendance	10		A	100-90
In-class Quizzes	20		B	89-80
Homework/Project	5		C	79-70
Tests/Exams	40		D	69-60
Final Exam	25		F	59 or below

Class Activities and Participation Grades
- Class activities will often occur each week.
- No late or replacement assignments will be accepted.
- These activities may be computer based or involve the textbook.
- Students must submit these assignments during a given time frame.

Quiz Information
- Closed-book quizzes will be given throughout the semester. Quizzes will be based on material covered in class and homework assignments.
- A quiz can be given in class or online using Taskstream or eCourses.

Final Exam Procedures
- The comprehensive final exam will be closed book.
- All students are required to take the final exam. No exemptions are given.
- It is the student's responsibility to arrive on time for the exam with all of the needed materials.

Expectations

Class attendance is required at Prairie View. Additionally, I have seen that there is a direct correlation between class attendance and student success. As such, your on-time attendance is expected. Attendance also counts for 10% of your grade. You are expected to remain in class until the class has ended. As a matter of courtesy, please notify me of any anticipated absences at least one day before (barring family emergencies or illnesses). **Please turn off your cell phones before class. Cell phone use during class is not tolerated.**

ChEG 2013 - Materials Science
Spring Semester 2020
Tentative Course Schedule

Week	Topic	No of Lectures	Text Ref
1	Introduction to Materials Science	2	Chapter 1 Chapter 2
2	Atomic Structure	3	Chapter 2
3	Atomic and Ionic Arrangements	3	Chapter 3
4	Imperfections in Solids	3	Chapter 4
5	Atom and ion movements in materials **Term Exam 1 Jan/Feb**	2	Chapter 5
6	Mechanical Properties of Materials	3	Chapter 6
7	Mechanical Properties of Materials	3	Chapter 6
8	Deformation and Strengthening Mechanism		Chapter 7
9	Deformation and Strengthening Mechanism **Term Exam 2 Feb**	2	Chapter 8
10	Mechanical Properties of Materials Failure and Fracture	3	Chapter 9
11	Mechanical Properties of Materials Failure and Fracture	2	Chapter 9
12	Solid Solution and Phase Equilibrium	3	Chapter 10
13	Strengthening and eutectic phase diagram Thanksgiving – Nov 21-23, 2019	3	
14	Composite Materials **Term Exam 3 Mar**	2	
15	Degradation of Materials and safety concerns	3	
16	Final Exam Review	1	
16	**Final Exam (Apr 29 – May 6, 2020)**		

University Rules and Procedures

Disability statement (See Student Handbook):

Students with disabilities, including learning disabilities, who wish to request accommodations in class should register with the Services for Students with Disabilities (SSD) early in the semester so that appropriate arrangements may be made. In accordance with federal laws, a student requesting special accommodations must provide documentation of their disability to the SSD coordinator.

Academic misconduct (See Student Handbook):

You are expected to practice academic honesty in every aspect of this course and all other courses. Make sure you are familiar with your Student Handbook, especially the section on academic misconduct. Students who engage in academic misconduct are subject to university disciplinary procedures.

Forms of academic dishonesty:

1. Cheating: deception in which a student misrepresents that he/she has mastered information on an academic exercise that he/she has not mastered; giving or receiving aid unauthorized by the instructor on assignments or examinations.
2. Academic misconduct: tampering with grades or taking part in obtaining or distributing any part of a scheduled test.
3. Fabrication: use of invented information or falsified research.
4. Plagiarism: unacknowledged quotation and/or paraphrase of someone else's words, ideas, or data as one's own in work submitted for credit. Failure to identify information or essays from the Internet and submitting them as one's own work also constitutes plagiarism.

Nonacademic misconduct (See Student Handbook)

The university respects the rights of instructors to teach and students to learn. Maintenance of these rights requires campus conditions that do not impede their exercise. Campus behavior that interferes with either (1) the instructor's ability to conduct the class, (2) the inability of other students to profit from the instructional program, or (3) campus behavior that interferes with the rights of others will not be tolerated. An individual engaging in such disruptive behavior may be subject to disciplinary action. Such incidents will be adjudicated by the Dean of Students under nonacademic procedures.

Sexual misconduct (See Student Handbook):

Sexual harassment of students and employers at Prairie View A&M University is unacceptable and will not be tolerated. Any member of the university community violating this policy will be subject to disciplinary action.

Attendance Policy:

Prairie View A&M University requires regular class attendance. Excessive absences will result in lowered grades. Excessive absenteeism, whether excused or unexcused, may result in a student's course grade being reduced or in assignment of a grade of "F". Absences are accumulated beginning with the first day of class.

Student Academic Appeals Process

Authority and responsibility for assigning grades to students, rests with the faculty. However, in those instances where students believe that miscommunication, errors, or unfairness of any kind may have adversely affected the instructor's assessment of their academic performance, the student has a right to appeal by the procedure listed in the Undergraduate Catalog and by doing so within thirty days of receiving the grade or experiencing any other problematic academic event that prompted the complaint.