



POLYTECHNIC UNIVERSITY OF PUERTO RICO
College of Engineering and Applied Sciences
COURSE SYLLABUS

Course code: ENGI 3510	Course Title: ENGINEERING MATERIALS	Classification: Required	Credits: 3
Prerequisites: SCIE 1214 or SCIE 1210, SCIE 1440, and SCIE 1441		Co-requisites: N/A	Schedule: Two two-hour lecture periods per week
Course Description: This course covers atomic structure and bonding in solids, the structure of crystalline solids, imperfections in solids, diffusion, mechanical properties of metals, dislocations and strengthening mechanisms, failure, phase diagrams, applications and processing of metal alloys, as well as the structure and properties of ceramics and polymers. Students will gain knowledge of solid material properties essential for engineering applications and an introduction to methods for modifying these properties for various applications and processes.			
Textbook: Callister Jr., William D. and Rethwisch, David G. (2020) Materials Science & Engineering: An Introduction , 10 th Ed., Wiley PLUS, ISBN-13: 978-1119721772, ISBN-10: 1119721776			
References: 1. Askeland, Donald R. and Wright, Wendelin J. (2015) The Science and Engineering of Materials , 7 th Ed., Cengage Learning, ISBN-13: 978-1305076761, ISBN-10: 1305076761 2. Shackelford, James F. (2014) Introduction to Materials Science for Engineers , 8 th Ed., Prentice-Hall, Inc., ISBN-13: 978-0133826654, ISBN-10: 0133826651 3. Haidemenopoulos, Gregory N. (2018) Physical Metallurgy: Principles and Design , 1st Ed., CRC Press, ISBN-13: 978-1138627680, ISBN-10: 1138627682			
Contribution to Professional Component: Engineering Science: 2 credits Engineering Design: 1 credit			
Relationship with Program Objectives: (01) an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics (05) an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives (04) an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts (07) an ability to acquire and apply new knowledge as needed, using appropriate learning strategies			
Course General Objectives: 1. Recognize the atomic structure, atomic bonding, structural defects, and its influence on the behavior of solid crystalline and non-crystalline materials. 2. Identify concepts of solid diffusion. 3. Recognize solid solution, grain size reduction, and cold work as methods for changing solids materials properties. 4. Identify the mechanical properties of solid materials because of bonding and structural defects. 5. Use phase diagrams. 6. Choose solid material for specific applications based on solid crystal structure, mechanical behavior, and thermal behavior. 7. Identify new and improved material developed in the industry using the Internet. 8. Analyze failure of mechanical elements and recommend better material. 9. Work in groups			

TOPICS COVERED			
Meeting	Chapter	Topic	Modules (OL)
1		Course introduction.	1
2	1	Introduction	1
3	2	Atomic Structure and Interatomic Bonding	2
4-5	3	Structure of Crystalline Solids	3
6	4	Imperfections in Solids	4
7	5	Diffusion	5
8		Exam 1	First Evaluation Activity
9-10	6	Mechanical Properties of Metals	6
11-12	7	Dislocation and Strengthening Mechanisms	7
13-14	8	Failure	8
15		Exam 2	Second Evaluation Activity
16-18	9	Phase Diagrams	9
19-20	11	Applications and Processing of Metal Alloys	10
21	12	Structures and Properties of Ceramics	11
22	14	Polymer Structures	12
23		Exam 3	Final Evaluation Activity
24		Final Exam or Project	Special Activity
Minimum Criteria for Evaluation:		Grading will be as follows:	
Three Partial Exams (Activities for modules-OL)	60%	100% to 90%	A
Assignments/Quizzes (Evaluation Activities-OL)	25%	89% to 80%	B
Final Exam or Project (Special Activity-OL)	15%	79% to 70%	C
Total	100 %	69% to 60%	D
		Less than 60%	F
Prepared by: Florabel Toro Revised by: OAC		Date of Last Revision: February 2025	