MECH3420 Engineering Materials II

Course Code: MECH3420	**Course Title:** Engineering Materials II
Required Course Or Elective Course: Elective	**Terms Offered (Credits):** Fall 2023-24 (3 credits)
Faculty In Charge: Hong Tao	**Pre-Requisites:** MECH 2410
Course Structure: 3 hour lecture per week, 1 hour tutorial per week	
Textbook/Required Material: MATERIALS SCIENCE AND ENGINEERING: AN INTRODUCTION; 9TH EDITION, WILLIAM D. CALLISTER, JR.	
Bulletin Course Description: ➢ Equip the students with fundamental knowledge of structure, properties, and fabrication of ceramics and polymers ➢ Extend the students' knowledge in engineering materials with a focus in green/smart building and aerospace engineering ➢ Establish the students' capability in advanced materials applications in green/smart buildings and aerospace engineering	
Course Topics: 1. Introduction to Engineering Materials II **Module I – Properties of General Engineering Materials** 2. Electrical Properties 3. Thermal Properties 4. Magnetic Properties 5. Optical Properties **Module II – Green / Smart Building Materials** 6. Ceramics – Crystal Structures, Properties, and Fabrications 7. Polymers – Structures, Properties, Synthesis, and Applications 8. Smart Insulation Materials for Buildings **Module III – Aerospace Engineering Materials** 9. Understanding Aerospace Materials 10. Aluminum Alloys and Magnesium Alloys for Aerospace Structures 11. Titanium Alloys for Aerospace Structures and Engines 12. Superalloys for Gas Turbine Engines 13. Materials degradation	
Course Objectives: (correlated program objectives)	(1) Equip the students with fundamental knowledge of electrical, thermal, magnetic, optical properties of engineering materials and their applications in real life products (P-O3) (2) Equip the students with fundamental knowledge of structure, properties, and fabrication of ceramics and polymers, respectively (P-O3) (3) Extend the students' capability in applying advanced thermal insulation materials in green building and smart windows (P-O3)

	(4) Extend the students' knowledge in advanced metal alloys with a focus in their application in aerospace structures and engines (P-O3)
Course Outcomes: (correlated course objectives and program outcomes)	On successful completion of this course, students are expected to be able to: A. Conduct calculation and analysis of parameters of electrical, thermal, magnetic, optical properties of engineering materials. (1) (POC1, POC3, POC4, POC5) B. Analyze basic structure and properties relationship of ceramics and polymers, respectively. (2) (POC1, POC3, POC4, POC5) C. Analyze the materials selections factors in design of green buildings. (3) (POC1, POC3, POC4, POC5) D. Perform analysis of advanced metal alloys applications in aerospace structures and engines. (4) (POC1, POC3, POC4, POC5)
Assessment Tools: (correlated course outcomes)	In – Class Activity – 20% (A, B, C, D) Assignments – 12% (A, B, C, D) Online Quizzes – 18% (A, B, C, D) Mid-term Exam – 20% (A, B, C, D) Final exam – 30% (A, B, C, D)

BEng in Mechanical Engineering (4-year program)
Program Objectives:

P-O1. Be able to communicate and perform as an effective engineering professional in both individual and team-based project environments,
P-O2. Have an international outlook with clear perspectives on the Pearl river Delta and Greater China,
P-O3. Be able to research, design, develop, test, evaluate and implement engineering solutions to problems that are of complexity encountered in professional practice and leadership,
P-O4. Clearly Consider the ethical implications and societal impacts of engineering solutions,
P-O5. Continuously improve through lifelong learning.

Program Outcomes:

POC1. ability to identify and formulate problems in multidisciplinary environment with an understanding of engineering issues and constraints;
POC2. ability to design and conduct experiments as well as analyze and interpret data;
POC3. ability to apply knowledge of mathematics, science, and engineering for problem solving in mechanical engineering and related sectors or for further education in a research career;
POC4. ability to develop specification and to design system, component, or process to meet needs;
POC5. ability to understand the manufacturability, maintainability, and recyclability of engineering system and components;
POC6. ability to use modern engineering tools, techniques, and skills in engineering practice;
POC7. ability to communicate effectively;
POC8. ability to function in multi-disciplinary teams and provide leadership;
POC9. broadly educated with an understanding of the impact of engineering solutions on issues such as economics, business, politics, environment, health and safety, sustainability, and societal context;
POC10. clear understanding of professional and ethical responsibilities;
POC11. recognition of the need for life-long learning and continuing education;
POC12. international outlook with knowledge of contemporary issues.