STATE UNIVERSITY OF NEW YORK
COLLEGE OF TECHNOLOGY
CANTON, NEW YORK

MASTER SYLLABUS

COURSE NUMBER – COURSE NAME
ENGS 205 – Materials Science

Created by: Dr. Rashid Aidun

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Canino School of Engineering Technology

Department: ELECTRICAL ENGINEERING TECHNOLOGY &

ENGINEERING !SCIENCE

Semester/Year: Fall 2018

A. **TITLE**: Materials Science

B. **COURSE NUMBER:** ENGS 205

C. **CREDIT HOURS: (Hours of Lecture, Laboratory, Recitation, Tutorial, Activity)**

 # Credit Hours: 3
 # Lecture Hours: **per week**
 # Lab Hours: **per week**
Other: **per week**

Course Length: 15 **Weeks**

D. **WRITING INTENSIVE COURSE**: Yes ☐ No ☒

E. **GER CATEGORY: None:** ☒ **Yes:** GER
***If course satisfies more than one*:** GER

F. **SEMESTER(S) OFFERED: Fall** ☒ **Spring** ☐ **Fall & Spring** ☐

G. **COURSE DESCRIPTION:**

The underlying atomic and crystalline structure of materials is studied and how these structures affect their engineering properties. The mechanical properties of metals, ceramics, polymers and composites are examined. The mechanism of Diffusion & strengthening are discussed. Gain knowledge about the types of imperfections that exist and the roles they play in affecting the behaviour of materials. Phase Diagrams of some alloys are studied.

H. **PRE-REQUISITES: None** ☐ **Yes** ☒ **If yes, list below:**

College Chemistry I (SHEM 150), University Physics II (PHYS 132), and Calculus II (MATH 162), or permission of the instructor.

CO-REQUISITES: None ☒ **Yes** ☐ **If yes, list below:**

I. STUDENT LEARNING OUTCOMES: (*see key below*)

By the end of this course, the student will be able to:

Course Student Learning Outcome [SLO]	***Program Student Learning Outcome [PSLO]***	***GER*** *[If Applicable]*	***ISLO & SUBSETS***	
Understand the crystalline and non-crystalline structures of materials	Prepare students to utilize modern computational tools for engineering programming, analysis, and design		ISLO 5-Ind, Prof, Disc, Know Skills ISLO	Subsets Subsets Subsets Subsets
Understand the effect of imperfections in crystalline structures	Prepare students to utilize modern computational tools for engineering programming, analysis, and design		ISLO 5-Ind, Prof, Disc, Know Skills ISLO	Subsets Subsets Subsets Subsets
Understand the structures of metals, polymers, and ceramics	Prepare students to utilize modern computational tools for engineering programming, analysis, and design		ISLO 5-Ind, Prof, Disc, Know Skills ISLO	Subsets Subsets Subsets Subsets
Explain and predict mechanical properties of materials	Prepare students to utilize modern computational tools for engineering programming, analysis, and design		ISLO 5-Ind, Prof, Disc, Know Skills ISLO	Subsets Subsets Subsets Subsets
Know how to select a material for a specific application	Prepare students to utilize modern computational tools for engineering programming, analysis, and design		ISLO 5-Ind, Prof, Disc, Know Skills ISLO	Subsets Subsets Subsets Subsets

KEY	**Institutional Student Learning Outcomes [ISLO 1 – 5]**
ISLO #	**ISLO & Subsets**
1	**Communication Skills** Oral [O], Written [W]
2	**Critical Thinking** *Critical Analysis [CA] , Inquiry & Analysis [IA] , Problem Solving [PS]*
3	**Foundational Skills** *Information Management [IM], Quantitative Lit,/Reasoning [QTR]*
4	**Social Responsibility** *Ethical Reasoning [ER], Global Learning [GL], Intercultural Knowledge [IK], Teamwork [T]*
5	**Industry, Professional, Discipline Specific Knowledge and Skills**

*Include program objectives if applicable. Please consult with Program Coordinator

J. APPLIED LEARNING COMPONENT: Yes ☐ No ☒

If YES, select one or more of the following categories:

☐ Classroom/Lab
☐ Internship
☐ Clinical Placement
☐ Practicum
☐ Service Learning
☐ Community Service
☐ Civic Engagement
☐ Creative Works/Senior Project
☐ Research
☐ Entrepreneurship (program, class, project)

K. TEXTS:

Materials Science and Engineering, William D. Callister, 5th ed., John Wiley and Sons

L. REFERENCES:

Many articles and videos on Materials and Engineering Materials. Posted as needed

M. EQUIPMENT: None ☒ Needed:

N. GRADING METHOD: A - F

O. SUGGESTED MEASUREMENT CRITERIA/METHODS:

Participation
3 exams
Homeworks
Research papers
Final exam

P. DETAILED COURSE OUTLINE:

1. **Engineering Requirements of Materials**
   - **a. Defining properties**
   - **b. Measurement of properties**
   - **c. Environmental factors**
2. **Atomic Bonding**
   - **a. Atomic structure**
   - **b. Types of bonds**
   - **c. Classifying materials by bond type**
   - **d. Atomic coordination**
3. **Unit Cells**
   - **a. Mers**
   - **b. Ionic bond properties**
   - **c. Metallic bond properties**
   - **d. Covalent bond properties**
   - **e. Lattice structures**
   - **f. Planes and directions in unit cells**

g. x-ray analysis
h. glasses and liquids

4. Diffusion
a. Steady state diffusion
b. Non steady state diffusion

5. Imperfections in Unit Cells
a. Point defects
b. Dislocations
c. Crystal edges
d. Solid solutions
e. Imperfections in polymers

6. Mechanical Properties
a. Deformation of metals
b. Deformation of polymers
c. Mechanical properties of ceramics
d. Mechanical properties of composites

7. Phase Diagrams
a. Equilibrium phase diagram
b. Iron-carbide system
c. TTT diagrams
d. Heat treatments and microstructure

8. Stability of material in Service
a. Creep
b. Fracture
c. Fatigue
d. Corrosion

Q. <u>LABORATORY OUTLINE</u>: None ☒ Yes ☐