

# MSE-500: Materials Physics and Chemistry Winter 2023

## Syllabus

**Lecture: Mondays and Wednesdays  
3:00 PM – 4:30 PM; xxxx DOW**

**Instructor:** Prof. Pierre Ferdinand Poudeu  
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**Office Hours:** Mon and Wed; REMOTE (Zoom); 10:00 – 12:00 AM; or by appointment

**Textbook:** (1) Understanding Solids – The Science of Materials, second edition, Richard J D Tilley, John Wiley and Sons, LTD, 2013; ISBN: 978- 1-118-42328-8

**Synopsis:** Physical properties of a wide range of materials, with focus crystalline ceramic materials, from the atomic and electronic point of view. The bonding and structure of materials will be placed in context of quantum mechanics and band theory; and the ionic, electrical, thermal, and magnetic properties will be emphasized. We will focus our attention on the structural origin of functional properties observed in advanced inorganic materials (Ceramics). Topics such as (1) structural defects, (2) ionic conductivity, (3) electronic conductivity, (4) thermal conductivity, and (5) magnetic properties will be discussed emphasizing the microstructure-property relationships, and their applications in the design and production of advanced materials.

### Course Topics:

Chapter 1: Defects in Ceramic Materials  
Chapter 2: Diffusion and Ionic Conductivity in Ceramic Materials (Ch7 in Tilley)  
Chapter 3: Electronic Conductivity in Ceramic Materials (Ch13 in Tilley)  
Chapter 4: Thermal Properties of Ceramic Materials (Ch15 in Tilley)  
Chapter 5: Magnetism in Ceramic Materials (Ch12 in Tilley)

### Grading:

1) Quizzes: 10%  
2) In class participation/team discussion: 20%  
3) EXAM #1: 25%  
4) EXAM # 2: 25%  
5) Term Paper: 20%

You will write a Term Paper on a topic of your choosing related to “**Functional Ceramics: Design, Fabrication and Applications**”.