Course Information	
Course title	Ceramics Smart Materials
Semester	114-2
Department	Materials Science and Engineering
Instructor	Tzong-Lin Jay Shieh
Administrative Curriculum Number	MSE7042
Teaching Curriculum Number	527 M4400
Class	
Credits	3
Full/Half Yr.	Half
Required/Elective	Elective
Time	Thursday 7, 8, 9
Remarks	
Ceiba Web Server	
Table of Core Capabilities and Curriculum Planning	•☑ Professional knowledge of materials science •☐ Build the ability to write professional dissertation •☑ Build the ability to think innovatively and practice research independently •☑ Build the ability to solve problems and coordinate •☑ Build the capacity for lifelong self-learning
Course Syllabus	
Course Description	To provide the students with broad coverage of the physical properties, processing, and applications of ferroelectric materials.
Course Objective	1. Introduction to smart materials 2. Fundamental aspects of ferroelectrics 3. Parameters for ferroelectric ceramics and their measurement 4. Experimental hysteresis measurements 5. Principal ferroelectric types and applications 6. Fatigue crack growth in ferroelectrics 7. The multi-axial response of ferroelectrics under stress and electric field 8. Processing aspects of ferroelectric ceramics 9. Ferroelectric thin films and composites
Course Requirement	• Experimental Work

	• Mid-Semester Examination: Open book, 3 hours • Final Examination: Open book, 3 hours
Office Hours	By email arrangement.
References	The primary source of material will come from the lecture notes. No one textbook covers all of the material covered in the course. The course material draws from several textbooks which are available in the library; these textbooks are listed on the next page.
Designated reading	• **Electroceramics: Materials, Properties, and Applications**, A.J. Moulson and J.M. Herbert. • **Ferroelectric Materials and Their Applications**, Y. Xu.
Grading	

No.	Item	%	Explanations for the conditions
1.	Homework		
2.	Experimental	10 %	Bonus
3.	Midterm #1	50 %	
4.	Midterm #2		
5.	Final exam	50 %	

Progress

Week	Date	Topic
Week 1	2/26	Introduction to smart materials
Week 2	3/5	Fundamental aspects of piezoelectricity
Week 3	3/12	Fundamental aspects of piezoelectric, pyroelectric and ferroelectric materials
Week 4	3/19	Hysteresis evolution and characterization
Week 5	3/26	Constitutive relationships for piezoelectric effects
Week 6	4/2	Parameters for ferroelectric ceramics and their measurements
Week 7	4/9	Principal ferroelectric types and applications (perovskite systems)
Week 8	4/16	Midterm exam
Week 9	4/23	Principal ferroelectric types and applications (relaxor systems)
Week 10	4/30	Principal ferroelectric types and applications (tungsten-bronze-type)
Week 11	5/7	Principal ferroelectric types and applications (lithium niobate)
Week 12	5/14	Ferroelectric polymers and composites

Week 13	5/21	The multi-axial response of ferroelectrics under stress and electric field
Week 14	5/28	Processing aspects of ferroelectric ceramics
Week 15	6/4	Pyroelectricity and pyroelectric materials
Week 16	6/11	Final exam