EMA 6510 (SEC 05F6, 3 Credits)
"Survey of Materials Characterization Techniques"

MWF 6 (12:50-1:40PM), CSE 118
Office Hours: By Appointment

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Class Description & Goals:
This course will provide a foundation in the principles, theories, and applications of materials characterization techniques.

Content:
The listed topics might be presented in a slightly different order or may extend beyond the number of hours allocated to be covered. Any changes to this tentative schedule will be announced during class in a timely manner.

LECTURE TOPICS
Introduction - Optical Microscopy - Electron & Photon Probes
Optical Microscopy (OM) - Scanning Electron Microscopy (SEM) (1)
Scanning Electron Microscopy (SEM) (2)
OM and SEM Applications
Transmission Electron Microscopy (TEM) (1)
Transmission Electron Microscopy (TEM) (2)
Environmental Scanning Electron Microscopy (ESEM)
Optical and Stylus Profilometry
Scanning Probe Microscopy/ Atomic Force Microscopy (SPM/AFM) (1)
Elemental Analysis Techniques - Energy Dispersive Spectroscopy (EDS) (1)
Energy Dispersive Spectroscopy (EDS) (2)
Wavelenght Dispersive Spectroscopy (WDS)
X-Ray Fluorescence (XRF)
Total Reflection X-Ray Fluorescence (TRXF)
Auger Electron Spectroscopy (AES)
X-Ray Photoelectron Spectroscopy (XPS)
Static & Dynamic Secondary Ion Mass Spectrometry (Static & Dynamic SIMS)
Electron Energy Loss in the Transmission Electron Microscope (EELS)
Fourier Transformed Infrared Spectroscopy (FTIR) & ATR
Ion Scattering Spectroscopy (ISS) and Inductively Coupled Plasma Mass Spectrometry (ICPMS)
UV & Raman Spectroscopy
X-Ray Diffraction (XRD)
SAXS, GIXD, GISAXS, XRR
Electron Backscatter Diffraction (EBSD)
Introduction to Neutron Techniques - Neutron Diffraction & Neutron Reflectivity
Complementary Techniques & Special Holders
Complementary Techniques & Special Holders
Sample Preparation Equipment and Instrumentation

Grading:
Midterm: 30%
Group Projects: 30%
Final: 40%

Grading Scale:

Letter Grade	From	To
A	95	100
A-	90	94.99
B+	87	89.99
B	83	86.99
B-	80	82.99
C+	77	79.99
C	73	76.99
C-	70	72.99
D+	67	69.99
D	63	66.99
D-	60	62.99
E	0	59.99

References:

Encyclopedia of Materials Characterization: Surfaces, Interfaces, Thin Films (Materials Characterization Series). Eds: Brundle, C. R., Evans, C. A. Jr., Wilson S. 1992.
Publisher: Butterworth-Heinemann
ISBN-10: 0750691689
ISBN-13: 978-0750691680

Scanning Electron Microscopy and X-Ray Microanalysis, A Text for Biologists, Materials Scientists, and Geologists. Goldstein, J.I., Newbury, D.E., Echlin. P., Joy, D.C., Romig, A.D. Jr., Lyman, C.E., Fiori,C., and Lifshin, E. Third Edition. 2003.
Publisher: Springer, New York, NY
ISBN: 0-306-47292-9

Characterization of materials. John B. Wachtman, with chapters on X-ray methods by Zwi H. Kalman. 1993
Publisher: Boston : Butterworth-Heinemann ; Greenwich : Manning
ISBN: 0750692154

Materials characterization techniques. Zhang, S., Li, L., Kumar, A. 2009.
Publisher: Boca Raton : CRC Press
ISBN-10: 1420042947
ISBN-13: 9781420042948