

## Course Syllabus

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### Course Information

Course Number/Section	MSEN 5360 (MSEN5360-0W1)
Course Title	Materials Characterization
Term	Spring 2021
Days & Times	Recorded lectures available on-line by Mondays at 13:00 (local)
Location	On-line

### Professor Contact Information

Professors	Robert Wallace
Office Phones	972 883 6638
Email Addresses	<a href="mailto:rmwallace@utdallas.edu">rmwallace@utdallas.edu</a>
Office Location	NSERL
Office Hours	<b>By Appointment</b>
Other Information	Coursebook: <a href="https://coursebook.utdallas.edu/search/msen5360.0w1.21s">https://coursebook.utdallas.edu/search/msen5360.0w1.21s</a>

### Course Modality and Expectations

Instructional Mode	Online See: <a href="https://registrar.utdallas.edu/registration/">https://registrar.utdallas.edu/registration/</a>
Course Platform	eLearning website for MSEN 5360
Expectations	See below.
Asynchronous Learning Guidelines	See: <a href="https://registrar.utdallas.edu/registration/">https://registrar.utdallas.edu/registration/</a>

### COVID-19 Guidelines and Resources

The information contained in the following link lists the University's COVID-19 resources for students and instructors of record.

Please see <http://go.utdallas.edu/syllabus-policies>.

### Class Materials

The Instructor may provide class materials that will be made available to all students registered for this class as they are intended to supplement the classroom experience. These materials may be downloaded during the course, however, these materials are for registered students' use only. Classroom materials may not be reproduced or shared with those not in class, or uploaded to other online environments except to implement an approved Office of Student AccessAbility accommodation. Failure to comply with these University requirements is a violation of the [Student Code of Conduct](#).

### Course Pre-requisites, Co-requisites, and/or Other Restrictions

**Prerequisite: MSEN 5300. Prerequisite or Corequisite: MSEN 6319 or equivalent.**

***Students are also expected to have mastered the following topics at the undergraduate level prior to this course:***

Math: Geometrical Vectors, Exponential/Trigonometric Notation and Identities, Complex number notation and manipulation, Differential Calculus and Equations, Partial Differential Equations, Vector Calculus, Laplacian and Gradient operators, Summation/Product/Factorial Notation, Integral Calculus, Matrix Algebra and Determinants

Physics: Elementary Classical Mechanics, Electrostatics and Electromagnetism (Maxwell's Equations), Waves (Free space/Plane waves) and Diffraction, Polarization, Energy Density and Flow

Chemistry: Molecular Orbital Theory

### **Course Description**

Survey of atomic and structural analysis techniques as applied to surface and bulk materials. Physical processes involved in the interaction of ions, electrons and photons with solids; characteristics of the emergent radiation in relation to the structure and composition.

### **Student Learning Objectives/Outcomes**

You will be expected to achieve the following:

- Understand when to apply and the information obtained from the techniques of atomic, molecular and structural analysis.
- Understand the sensitivity and volume probed by each technique.
- Understand the properties of the probe radiation and detection of emitted radiation and particles.
- Understand the physics and chemistry of the absorption and emission of radiation and particles.
- Understand physical quantities and measurement uncertainty

You will be expected to demonstrate these objectives by problem solving in homework and exams.

### **Required Textbooks and Materials**

#### *Required Texts*

“*Fundamentals of Nanoscale Film Analysis*,” by T. L. Alford, L. C. Feldman and J.W.Mayer, Springer, ISBN: 978-0-387-29260-8

**This book is available as an e-book through the library [“Springer Link”](#)**

### **Suggested Course Materials**

#### *Suggested Readings/Texts*

C.R. Brundle, C. A. Evans, Jr., and S. Wilson, *Encyclopedia of Materials Characterization*, Butterworth-Heinemann, ISBN 0-7506-9168-9 (1992).

J.B. Wachtman, *Characterization of Materials*, Butterworth-Heinemann, ISBN 0-7506-9215-4 (1992).

ASM Handbook, *Materials Characterization Vol. 10*, ISBN 0-87170-007-7 (1986).

#### *Suggested Materials*

J. Moore, C. Davis, M. Coplan, S. Greer, *Building Scientific Apparatus*, Westview Press, 3<sup>rd</sup> edition, ISBN 0813340063 (2002)

### **On College Math**

1. Clifford E. Swartz, “*Used Math*,” ISBN-13: 978-0139397448 (Prentice-Hall (1972))

### **On College Chemistry/Physics**

2. See the McDermott Library On-line Resources!

Textbooks and some other bookstore materials can be ordered online or purchased at the [UT Dallas Bookstore](#).

### **Technical Requirements**

In addition to a confident level of computer and Internet literacy, certain minimum technical requirements must be met to enable a successful learning experience. Please review the important technical requirements on the [Getting Started with eLearning](#) webpage.

### **Course Access and Navigation**

This course can be accessed using your UT Dallas NetID account on the [eLearning](#) website.

Please see the course access and navigation section of the [Getting Started with eLearning](#) webpage for more information.

To become familiar with the eLearning tool, please see the [Student eLearning Tutorials](#) webpage.

UT Dallas provides eLearning technical support 24 hours a day, 7 days a week. The [eLearning Support Center](#) includes a toll-free telephone number for immediate assistance (1-866-588-3192), email request service, and an online chat service.

### **Communication**

This course utilizes online tools for interaction and communication. Some external communication tools such as regular email and a web conferencing tool may also be used during the semester. For more details, please visit the [Student eLearning Tutorials](#) webpage for video demonstrations on eLearning tools.

Student emails and discussion board messages will be answered within 3 working days under normal circumstances.

### **Distance Learning Student Resources**

Online students have access to resources including the McDermott Library, Academic Advising, The Office of Student AccessAbility, and many others. Please see the [eLearning Current Students](#) webpage for more information.

### **Server Unavailability or Other Technical Difficulties**

The University is committed to providing a reliable learning management system to all users. However, in the event of any unexpected server outage or any unusual technical difficulty which prevents students from completing a time sensitive assessment activity, the instructor will provide an appropriate accommodation based on the situation. Students should immediately report any problems to the instructor and also contact the online [eLearning Help Desk](#). The instructor and the eLearning Help Desk will work with the student to resolve any issues at the earliest possible time.

Textbooks and some other bookstore materials can be ordered online or purchased at the [UT Dallas Bookstore](#).

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## Assignments & Academic Calendar

(Note: This is a tentative schedule and may be changed at the discretion of the faculty.)

Topics, Reading Assignments, Timeline, and Important Dates

Week	Date	Lecture #	Topic – Readings (Homework will be regularly assigned.)
<b>2021</b>	<b>2021</b>		
4	1/25	1	Overview: Concepts, Units, Bohr Atom, Vacuum Technology – Ch. 1+Notes
5	2/1	2	Detection Limits, Errors and Error Analysis + Optical Microscopy - Notes
6	2/8	3	Atomic Collisions, Backscattering Spectrometry – Ch. 2
7	2/15	4	Energy Loss of Light Ions, Backscattering Depth Profiles – Ch. 3
8	2/22	5	Sputter Depth Profiling + Secondary Ion Mass Spectrometry- Ch. 4
9	3/1	6	Electron Interactions, Depth Sensitivity in Electron Spectroscopies – Ch. 6
<b>10</b>	<b>3/8</b>		<b>Midterm Exam</b>
11	3/15	To 3/19	<b>University Holiday</b>
12	3/22	7	Surface and Thin Film Structure – Ch. 7-8
13	3/29	8	Photon Absorption in Solids – Ch. 9
14	4/5	<b>9</b>	Photoelectron Spectroscopy – Ch. 10
15	4/12	10	Radiative Transitions, Electron Microprobe Analysis – Ch. 11
16	4/19	11	Non-Radiative (Auger) Transitions – Ch. 12
17	4/26	12	Scanning Probe Techniques – Ch. 14+Notes
18	5/3	13	Characterization using Light - Notes
19	5/10		<b>Final Exam (See Coursebook/e-Learning)</b>

**Other important dates: Last date to withdraw is 3/27**

### Grading Policy

Grades will be based on the following weights:

Homework 25 %; Midterm 35 %; Final Exam 40 %

### Homework Assignments

These are **due to the instructor via UTD email in PDF format no later than THE START OF CLASS (13:00 local time) on the due date. No exceptions.**

Assignments will be posted on the e-Learning site for this course.

Homework must be presented in a professional, legible manner to be graded.

Collaboration (NOT copying) is encouraged. Cite all resources used. See Academic Integrity Statement in <http://go.utdallas.edu/syllabus-policies>.

### Examinations

Examinations will be held on line during an assigned time window and will be written.

### Course Policies

*Make-up exams*

**No make up exams will be given except under extreme circumstances.**

*Extra Credit*

**Not offered.**

*Late Work*

**Not Accepted.**

*Special Assignments*

**None.**

*Class Attendance*

**ONLINE**

*Classroom Citizenship*

**The Student Conduct and Discipline policy of the University of Texas at Dallas will be followed. See: <http://go.utdallas.edu/syllabus-policies>**

**Field Trip Policies / Off-Campus Instruction and Course Activities**

*None*

**Comet Creed**

*This creed was voted on by the UT Dallas student body in 2014. It is a standard that Comets choose to live by and encourage others to do the same:*

“As a Comet, I pledge honesty, integrity, and service in all that I do.”

**UT Dallas Syllabus Policies and Procedures**

The information contained in the following link constitutes the University’s policies and procedures segment of the course syllabus.

Please go to <http://go.utdallas.edu/syllabus-policies> for these policies.

***These descriptions and timelines are subject to change at the discretion of the Professor. The Instructor may change material, course content, and course pace or item sequence at any time.***