

EE/NANO 4391 - Course Syllabus

Course Information

<i>Course Number/Section</i>	EE/NANO 4391
<i>Course Title</i>	Technology of Plasma
<i>Term</i>	Fall 2016
<i>Days & Times</i>	MW 10:00 - 11:15 AM
<i>Place</i>	ECSN 2.120

Professor Contact Information

<i>Professor</i>	Lawrence J. Overzet
<i>Office Phone</i>	(972)UTD-2154
<i>Email Address</i>	overzet@utdallas.edu
<i>Office Location</i>	ECSN 4.708 – Come on by! You’ll have to check in at the front desk.
<i>Office Hours</i>	MW, 11:30 – 1:00 PM in ECSN 4.708
<i>Other Information</i>	I will use E-Learning.

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

Prerequisites: ENGR 3300 and CE/EE 3310. Recommended: ENGR 3341.

Corequisites: None.

Course Catalog Description

(3 semester hours) Plasmas are critical to making the best electronic devices. This class will be an introduction to the technology required to make and use these plasmas. Topics include: high-vacuum technology (gas properties, pumps, pressure gauges, flow-meters, gas composition analysis) and plasma technology (etch, deposition, and lamps).

Student Learning Objectives/Outcomes

1. Ability to describe the properties and uses of industrially relevant plasmas.
2. Ability to explain gas kinetics.
3. Ability to identify and understand the use of vacuum equipment.
4. Ability to describe chemical reactions occurring in plasmas.

Required Textbooks and Materials

Required Text

1. “Industrial Plasma Engineering. Volume 1: Principles” by J. R. Roth (Taylor & Francis, 1995. ISBN-13: 9780750303170, ISBN: 0750303174). This book is a bit old, but, some information is “timeless” and the rest can be updated in class! You can read this book for free (online) using the UTD Library.

Required Materials

n/a

Suggested Course Materials

Suggested Readings/Texts

1. "A User's Guide to Vacuum Technology, 3rd Edition" J. F. O'Hanlon, John Wiley and Sons, Inc., 2003.
2. "Plasma Etching: An Introduction" Edited by D. M. Manos and D. L. Flamm, Academic Press, Inc., 1989.
3. "Plasma engineering applications from aerospace to bio- and nanotechnology." By M. Keidar and I. Beilis Academic Press, Waltham, MA, 2013. (ISBN: 9780123859785.) (Available online at Library.)
4. "Introduction to Plasma Technology" J. E. Harry, Wiley-VCH Verlag GmbH & Co. KGaA, 2010. (Available online at Library.)

Suggested Materials

n/a

Approximate Course Schedule: This is an aggressive schedule and we may deviate from it.

JR: Text by J. Roth. S&B: Text by Streetman and Banerjee (from EE/CE 3310). JFO: Text by J. F. O'Hanlon (recommended and available in the library).

Date	Topic	Reading
8/22	Introduction Part I. Overview, History, Types and Uses of Plasmas.	NAS Report
8/24	Introduction Part II. Processes, Typical plasma parameters, Equipment.	JR 1.3-7
8/29	Gas Kinetic Theory I: Gas Law, Distribution Functions and Moments	JR 2.1-2, JFO 2
8/31	Gas Kinetic Theory II: Collisions and Gas Transport Regimes.	JR 2.3-5, JFO 3.1-3
9/5	Labor Day Holiday	
9/7	Gas Kinetic Theory III: Finish up	
9/12	Technology of Gases - Pumps, Pump-Systems, Vacuum Reactors	JFO 7, 10, 11
9/14	Technology of Gases - Pressure and Flow Meters.	JFO 5, 6
9/19	Technology of Gases - Conductance and Gas Flow Control.	JFO 22
9/21	Technology of Gases - Reactive Gas Handling and Safety.	Handout
9/26	Plasma Theory I: Charged Particle Motions (E[dc, ac], H[dc])	JR 3.1-4
9/28	Plasma Theory II: Collective Particle Motions, Diffusion	JR 4.1-2, 4.7, S&B 4.4
10/3	EXAM 1 - to end of Technology of Gases	
10/5	Plasma Theory III: Ambipolar Diffusion	JR 4.4-5, 4.7
10/10	Plasma Theory IV: Space Charge Limited Currents	JR 3.6
10/12	Plasma Theory V: Plasma Anatomy I	JR 4.9, 9.1, 11.1, 12.4
10/17	Plasma Theory VI: Plasma Anatomy II	JR 4.9, 9.1, 11.1, 12.4
10/19	Plasma Theory VII: Plasma Anatomy III	JR 10.1-2
10/24	Plasma Theory VIII: DC Sheaths	Handout
10/26	Plasma Technology I: Power Deposition and Impedance Matching	none
10/31	Plasma Technology II: Diagnostics of Conductivity and Permittivity	Handout
11/2	Plasma Technology III: Langmuir Probes, Optical Spectroscopy	none
11/7	Plasma Technology IV: Substrate Holders (Clamp, Cooling, Power)	none
11/9	Plasma Technology V: Finish	none
11/14	Surface reactions, Ion bombardment	Handout
11/16	Etching Plasmas I: chemical, physical, ion-enhanced processes	S&B 5.1.7, Handout
11/21,23	FALL BREAK WEEK	
11/28	EXAM 2 - to end of Plasma Technology	
11/30	Etching Plasmas II: ARDE, Etch endpoint detection, Etch-stop	Handout
12/5	Deposition Plasmas	S&B 5.1.8
12/7	Lighting plasmas: Fluorescent Lamps, Arc Lamps	Handout
12/XX	FINAL EXAM PERIOD 10:00 to 12:45 PM	

Grading Policy

- 25% Homework.
- 25% Exam I
- 25% Exam II
- 25% Final Exam – or Report

Course Policies

Make-up exams: You must have written permission from Dr. Overzet to take an exam at an alternate time and you must have that permission at least 1 hour in advance of the regularly scheduled exam time.

Make-up quizzes: Missed quizzes cannot be made up. Student attendance at all class periods is required and a quiz may be given at any time during any class period.

Extra Credit: None.

Late Work: Homework will be assigned on Monday or Wednesday and is due at the beginning of class on the following Monday. Each student must turn in individual work. All assigned work will be collected. Late HW will be reduced in credit by 20% per day late.

Special Assignments: None

Class Attendance: Required (Students will need to obtain handouts and unique material will be discussed in class lectures.)

Classroom Citizenship: Each student is expected to add to discussion.

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.

The descriptions and timelines contained in this syllabus are subject to change at the discretion of the Professor.