COURSE #: NERS 575; CREDITS: 4/Selective	**COURSE TITLE:** Plasma Generation and Diagnostics Laboratory
TERMS OFFERED: Winter	**For each prerequisite below, “E” denotes Enforced and “A”denotes Advised.**
TEXTBOOKS/REQUIRED MATERIAL: Lieberman & Lichtenberg, *Principles of Plasma Discharges and Materials Processing*	**PREREQUISITES:** Preceded or accompanied by course covering electromagnetism (A)
INSTRUCTOR(S): Ron Gilgenbach	**COGNIZANT FACULTY:** Gilgenbach
CoE BULLETIN DESCRIPTION: Laboratory techniques for plasma ionization and diagnosis relevant to plasma processing, propulsion, vacuum electronics, and fusion. Plasma generation techniques include: high voltage-DC, radio frequency, and e-beam discharges. Diagnostics include: Langmuir probes, microwave cavity perturbation, microwave interferometry, laser schlieren, and optical emission spectroscopy. Plasma parameters measured are: electron/ion density and electron temperature.	**COURSE TOPICS:** High Vacuum Systems (4.5), DC Breakdown/Discharge (4.5), Radio Frequency Breakdown (4.5), Space-Charge-Limited Emission from Thermionic Cathodes (4.5), Langmuir Probes, I, DC Plasma (4.5), Microwave Cavity Perturbation by a Plasma (4.5), Langmuir Probes II, RF Plasma (4.5), Microwave Interferometry, 2 weeks (6.5), Plasma Temperature from Spectroscopy (4.5), Laser Schlieren Photography (4.5), Diagnostics on an RF Plasma Reference Reactor (4.5), Inductively Coupled Plasmas (4.5)
COURSE STRUCTURE/SCHEDULE: 1 per week @ 80 minutes; Laboratory: 1 per week @ 3.5 hours	
COURSE OBJECTIVES For each Course Objective, links to the Program Educational Objectives are shown	1. To teach students fundamental principles of plasma ionization by DC and radio frequency electric fields and electron beams [1,2] 2. To teach students high vacuum techniques, [1,2] 3. To teach students plasma probe principles and interpretation, [1,2] 4. To teach students microwave diagnostics of plasmas, [1,2] 5. To teach students optical and laser diagnostics of plasmas, [1,2] 6. To apply fundamental principles to experiments to analyze the breakdown and diagnosis of plasmas [1,2] 7. To work in groups and to effectively and accurately communicate experimental data through graphs and written reports [3]
COURSE OUTCOMES For each Course Outcome, links to The Program/ ABET Student Outcomes are shown [#,a-k]	1. Demonstrate a working knowledge of plasma ionization and breakdown [1-3|ABET a,k,e] 2. Demonstrate a fundamental understanding of plasma concepts, such as ionization potential, Debye sheaths, Maxwellian distributions [1-3|ABET a,k,e] 3. Acquire a working knowledge of plasma diagnostic techniques to measure electron and ion density and temperature [3,10|ABET e,i] 4. Analyze diagnostic data to measure floating potential and plasma potential,[5|ABET b] 5. To demonstrate the ability to apply the diagnostic principles to industrially relevant plasma processing tools [2,10|ABET k,i] 6. To work in groups and to effectively and accurately communicate experimental data through graphs and written reports [7|ABET g]

ASSESSMENT TOOLS For each assessment tool, links to the Course Outcomes are identified	1. A combination of during term tests and/or a final examination will be used to measure outcomes [1-5] for individual students under a time constraint. 2. Laboratory reports will be required for each lab to present, analyze and interpret experimental data to measure all outcomes 3. Course evaluation by each student at the end of the course assesses all outcomes 4. Faculty self-assessment provides self-assessment data on all outcomes.

Revision History: September, 1998; December, 2004; June, 2010