Plasma Measurement I

(SS7011)

Course Overview

Instructor: Chi-Kuang Chao

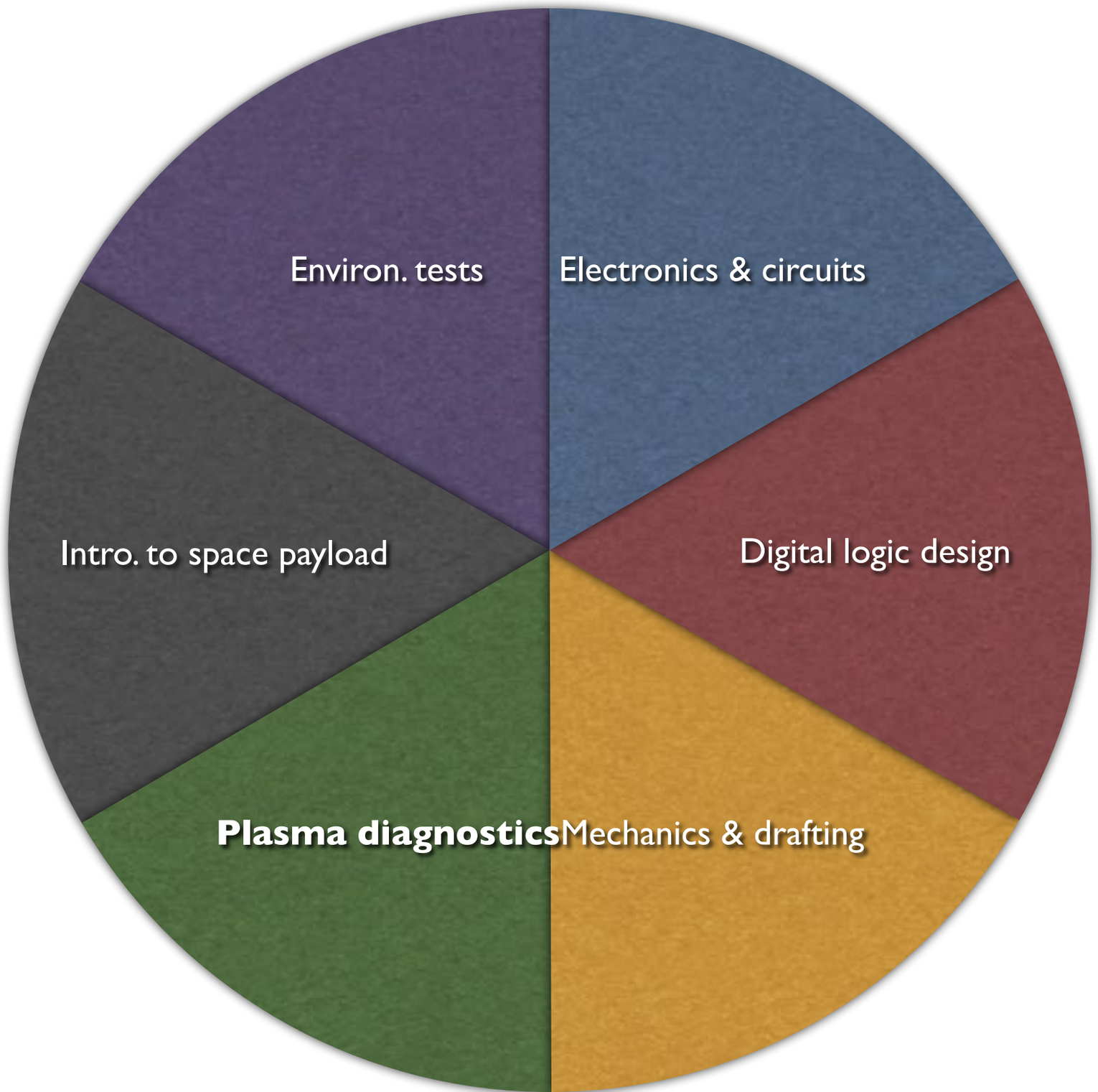
Graduate Institute of Space Science, National Central University

September 14, 2016

Syllabus

- Instructor: Chi-Kuang Chao
- Lecture time: 3 hours/week
- Lecture hours: 9:00 - 11:50 (WED)
- Classroom location: S4-917

Space payload



Course outline

- Basic equations of plasma diagnostics
- Langmuir probes
- Ion probes
- Missions

Basic equations of plasma diagnostics

- Kinetic theory of gases
- Theory of diodes (planar, cylindrical, and spherical types)
- Plasma sheaths (low voltage DC sheath approximation, Bohm sheath model, Child law sheath, etc.)

Langmuir probes

- I-V curves
- Single probes
- Double probes

Ion probes

- Theory of ion fluxes
- Data fitting to I-V curves
- Coordinate transformation and data calibration

Missions

- Ionospheric Plasma Electrodynamic Instrument onboard ROCSAT-1 satellite
- Ion probes onboard SR-V
- Plasma probes onboard SR-VII
- Space Plasma Sensor Package onboard SR-IX
- Advanced Ionospheric Probe onboard FORMOSAT-5 satellite
- Other missions

References

Forrester, A. T., *Large Ion Beams, Fundamentals of Generation and Propagation*, John Wiley & Sons, Inc., 1988

Huddlestone, R. H. and S. L. Leonard, *Plasma Diagnostic Techniques*, 1968

Hutchinson I. H., Principles of Plasma Diagnostics, Cambridge University Press, New York, 1987

Kruer, W., The Physics of Laser Plasma Interactions, Addison-Wesley Publishing Co., 1988

Lochte-Holtgreven, W., Plasma Diagnostics, North-Holland Publishing Company, Amsterdam, 1968

Raizer Y. P., *Gas Discharge Physics*, Springer-Verlag, Berlin, 1991

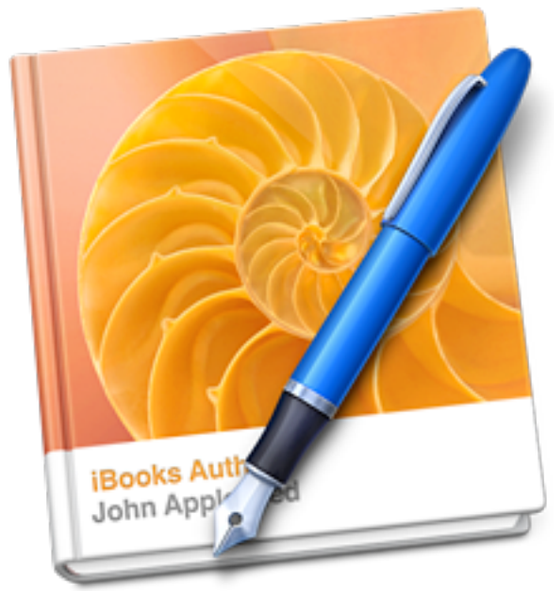
Roth, J. R., *Industrial Plasma Engineering, Volume 1: Principles*, IOP Publishing Ltd, Bristol, 1995

Course materials

- In-class lecture slides: were presented during the session and can be downloaded before the session begins
- Downloaded them from http://athena.ss.ncu.edu.tw/

Course materials (cont.)

- Available free on the Mac App Store, iBooks Author is an amazing new app that allows anyone to create beautiful Multi-Touch textbooks — and just about any other kind of book — for iPad. With galleries, video, interactive diagrams, 3D objects, and more, these books bring content to life in ways the printed page never could.



Grading

- Homework or presentation: 100%

Progress

Semester	2006/09	2007/03	2007/09	2008/03	2008/09	2009/03	2009/09	2010/03	2010/09	2011/03	2011/09	2012/03
Course	Plasma Measurement I	Plasma Measurement II	Plasma Measurement I	Plasma Measurement II	Plasma Measurement I	Plasma Measurement II	N/A	N/A	Plasma Measurement I	Plasma Measurement II	Calibration and Test for Space Instruments I	Calibration and Test for Space Instruments II
Students	9	9	6	4	7	4	N/A	N/A	6	4	8	9
Failed	0	0	0	0	0	0	N/A	N/A	0	0	0	0
Evaluation	4.42	4.79	4.77	4.51	4.08	4.92	N/A	N/A	4.6	4.44	3.72	3.92
Semester	2012/09	2013/03	2013/09	2014/03	2014/09	2015/03	2015/09	2016/03	2016/09	2017/03	2017/09	2018/03
Course	Plasma Measurement I	Plasma Measurement II	Calibration and Test for Space Instruments I	Calibration and Test for Space Instruments II	Plasma Measurement I	Plasma Measurement II	Calibration and Test for Space Instruments I	Calibration and Test for Space Instruments II	Plasma Measurement I	Plasma Measurement II	Calibration and Test for Space Instruments I	Calibration and Test for Space Instruments II
Students	5	4	5	5	4	5	5	7	6	--	--	--
Failed	0	0	0	0	0	0	0	0	--	--	--	--
Evaluation	3.96	4.15	4.03	4.48	4.92	4.56	4.83	4.67	--	--	--	--

Week #	1st session	2nd session	3rd session
1 (9/14)	Course overview	Basic equations of plasma diagnostics - kinetic theory of gases	
2 (9/21)	Basic equations of plasma diagnostics - kinetic theory of gases		
3 (Typhoon Megi, 9/28)	Break		
4 (10/5)	- kinetic theory of gases	Prof. Takahashi's talk	
5 (10/12)	Basic equations of plasma diagnostics - theory of diodes		
6 (APSCO, 10/19)	Break		
7 (APSCO, 10/26)	Break		
8 (11/2)	Basic equations of plasma diagnostics - plasma sheaths		
9 (mid-term, 11/9)	Break		
10 (Game Day, 11/16)	Break		
11 (11/23)	Basic equations of plasma diagnostics - plasma sheaths		
12 (11/30)	Langmuir probes - I-V curves		
13 (12/7)	Langmuir probes - single probes		
14 (12/14)	Langmuir probes - single probes		
15 (12/21)	Langmuir probes - single probes		
16 (12/28)	Langmuir probes - double probes		
17 (1/4)	Langmuir probes - double probes		
18 (final, 1/11)	Presentations		

For more information

- Please visit the course web pages at http://athena.ss.ncu.edu.tw/
- Contact me
  - By phone:
    - Ext.65754 at S4-804
    - Ext.36755 at S4-820
    - Ext.65781 at S4-811
- By e-mail: ckchao@jupiter.ss.ncu.edu.tw