ENGINEERING

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ECE 558: Charged Particle Beams and High Power Microwaves
Spring 2021
MW 1600-1715 WOOD-147
(Updated 11/11/2020)

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Office Hours: By appointment.

Catalog Description: "Overview of physics of particle beams and applications at high-current and high-energy. Topics include review of collective physics, beam emittance, space-charge forces, transport at high power levels, and application to high power microwave generation."

Web Enhanced: http://learn.unm.edu (you need to be registered for the course; use your UNM NetID and password to access).

Prerequisites: ECE 557 **or** permission of the Instructor.

Text: J. Benford, J. Swegle, and E. Schamiloglu, *High Power Microwaves, 3rd Ed.* (CRC Press, Boca Raton, FL, 2016).

There will be a problem set biweekly (on average). Some problems will involve computer solutions and plotting, so you will need access to software with math and plotting functions, such as Matlab, Mathematica, *etc.* There will be a final project and presentation, which will be described in more detail in class. Your final grade will be based on:

Problem Sets	50
Student Presentations	50
Final Grade	**100**

Emphasized topics are:

1. Fundamental HPM concepts
2. Enabling technologies
3. Beamless systems
4. Relativistic magnetrons and MILOs
5. Cerenkov devices
6. Klystrons and reltrons
7. Vircators
8. Gyro-devices
9. Free electron lasers

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Syllabus - Lecture No. and Topics*

	Week #	Topic
1. 01/18	**1**	Introduction to the Course/Background Information
2. 01/20		Introduction to Charged Particle Beams and High Power Microwaves
3. 01/25	**2**	Fundamentals – Basic EM **(Chap. 4)**
4. 01/27		Fundamentals – Periodic SWSs **(Chap. 4)**
5. 02/01	**3**	Fundamentals – Metamaterials/Cavities **(Chap. 4)**
6. 02/03		Fundamentals – Intense Beams **(Chap. 4)**
7. 02/08	**4**	Fundamentals – Beam/Wave Interactions **(Chap. 4)**
8. 02/10		Fundamentals – Wrap-up **(Chap. 4)**
9. 02/15	**5**	Enabling Technologies – Pulsed Power Drivers **(Chap. 5)**
10. 02/17		Enabling Technologies – Cathodes and Beams **(Chap. 5)**
11. 02/22	**6**	Enabling Technologies – Pulse Compression/Antennas/Plasma Diagnostics **(Chap. 5)**
12. 02/24		Enabling Technologies – Computational Techniques **(Chap. 5)**
13. 03/01	**7**	Cerenkov Devices **(Chap. 8)**
14. 03/03		Cerenkov Devices **(Chap. 8)**
15. 03/08	**8**	Beamless Systems - Introduction **(Chap. 6)**
16. 03/10		Beamless Systems - NLTLs **(Chap. 6)**
		03/14- 03/21 Spring Break
17. 03/22	**9**	Relativistic Magnetrons and MILOs **(Chap. 7)**
18. 03/24		Relativistic Magnetrons and MILOs **(Chap. 7)**
19. 03/29	**10**	Vircators **(Chap. 10)**
20. 03/31		Vircators **(Chap. 10)**
21. 04/05	**11**	Klystron and Reltrons **(Chap. 9)**
22. 04/07		Klystron and Reltrons **(Chap. 9)**
23. 04/12	**12**	Gyro-Devices **(Chap. 11)**
24. 04/14		Free Electron Lasers **(Chap. 11)**
25. 04/19	**13**	Student Presentations (3)
26. 04/21		Student Presentations (3)
27. 04/26	**14**	Student Presentations (3)
28. 04/28		Student Presentations (3)
29. 05/03	**15**	Student Presentations (3)
30. 05/05		Student Presentations (1)

* Subject to minor changes. Use this as a guide to read the textbook in advance.