SPRING 2022 Department of Physics & Astronomy, UGA
PHYS 8202 Advanced Electromagnetic Theory II (updated as of Apr. 19/2022)
The course syllabus is a general plan for the course; deviations announced to the class by the instructor may be necessary.

Course Description:	**A study of classical electrodynamics. Topics include development of Maxwell's electromagnetic field equations and the Lorentz force equation, electrostatics and magnetostatics, time-varying fields, conservation laws, radiating systems, and electromagnetic waves.**
Athena Title:	Adv EM Theory II
Pre or Corequisite:	PHYS 8201
Grading System:	A-F (Traditional)
Instructor:	Dr. Andrei Galiautdinov
Office:	Physics 220
Email:	ag1@uga.edu
Sections:	**27364** 09:35am – 10:50am (TTH)
Office hours:	3:35pm – 4:35pm (TTH)
Main Text:	**(LL) L. D. Landau & E. M. Lifshitz**, *Electrodynamics of Continuous Media*, 2nd edition (Course of Theoretical Physics, vol. 8; Pergamon Press, 1984)
Additional Texts:	**J. D. Jackson**, *Classical Electrodynamics* (3rd ed., Wiley, 1999; other eds. OK) **A. Zangwill**, *Modern Electrodynamics* (CUP, 2013) "Typos & Corrections" are available at http://www.prism.gatech.edu/~az2/ **D. J. Griffiths**, *Introduction to Electrodynamics*, 4th Edition (Pearson, 2013) **R. P. Feynman**, Lectures on Physics, vol. II, *Electromagnetism* **L. D. Landau & E. M. Lifshitz**, *The Classical Theory of Fields* (Course of Theoretical Physics, vol. 2; Butterworth-Heinenann, 1996)
Additional Materials	Will be posted on the eLC-New, http://elcnew.uga.edu
Academic Honesty:	As a University of Georgia student, you have agreed to abide by the University's academic honesty policy, "A Culture of Honesty," and the Student Honor Code. All academic work must meet the standards described in "A Culture of Honesty" found at: www.uga.edu/honesty. Lack of knowledge of the academic honesty policy is not a reasonable explanation for a violation. Questions related to course assignments and the academic honesty policy should be directed to the instructor. UGA Student Honor Code: "I will be academically honest in all of my academic work and will not tolerate academic dishonesty of others." A Culture of Honesty, the University's policy and procedures for handling cases of suspected dishonesty, can be found at www.uga.edu/ovpi.
Grades:	Your grades will be posted on the eLC-New, http://elcnew.uga.edu
Grading policy:	**70% HOMEWORK** (no make-up; must be submitted by the due date) **10% EXAM 1** (no individual re-scheduling or make-up) **10% EXAM 2** (no individual re-scheduling or make-up) **10% Final Exam** (no individual re-scheduling or make-up)
Cut-offs:	F : [0, 60) D : [60, 68) C–: [68, 70) C: [70, 75) C+: [75, 78) B–: [78, 80) B: [80, 85) B+: [85, 88) A–: [88, 90) A: [90, 100] NOTE: No rounding; 89.99 = A–, etc.
Grade appeal:	Grade appeals are resolved by following our departmental due procedure as described here: https://www.physast.uga.edu/policies/policiesonstudentissues/grievance
Incompletes:	No "Incompletes" will be assigned in this class unless requested by the UGA Student Care and Outreach office.
Hardship withdrawals:	If your course performance is significantly affected by issues beyond your control, please seek assistance promptly from Student Care and Outreach 706-542-7774 or visit https://sco.uga.edu. They will help you navigate any difficult circumstances you may be facing by connecting you with the appropriate resources or services. It is always easier to address exceptional circumstances when you raise these concerns as early as possible. Waiting until the end of the semester to take action may limit my ability to provide appropriate support.
Mental Health and Wellness Resources:	UGA has several resources for a student seeking mental health services (https://www.uhs.uga.edu/bewelluga/bewelluga) or crisis support (https://www.uhs.uga.edu/info/emergencies). If you need help managing stress anxiety, relationships, etc., please visit BeWellUGA

	(https://www.uhs.uga.edu/bewelluga/bewelluga) for a list of FREE workshops, classes, mentoring, and health coaching led by licensed clinicians and health educators in the University Health Center. Additional resources can be accessed through the UGA App.
Key topics:	Elements of antenna theory Electrostatics of conductors Electrostatics of dielectrics Steady current and conductivity Magnetostatics of magnetics Harmonically oscillating fields in media Temporal (frequency) dispersion Electromagnetic waves in various media Reflection and refraction at interfaces via Maxwell's theory (if time permits)

2022 Spring Detailed Schedule

(NOTE: This schedule is preliminary, modifications may be necessary.)

Wk	Day	Date	Meeting	Reading/Topics
1	M	Jan. 10		
	T	Jan. 11	**1. PART 1: Elements of antenna theory**	Informal intro to radiating systems (a physicist's perspective)
	W	Jan. 12		
	R	Jan. 13	**2.**	Radiation by a short dipole
	F	Jan. 14		**Drop/Add ends**
2	M	Jan. 17		MLK Day
	T	Jan. 18	**3.**	Radiation by a short dipole (cont.)
	W	Jan. 19		
	R	Jan. 20	**4.**	Radiation by a short dipole (cont.) Poynting's vector field in the far zone Thin linear antenna (only if time permits; likely will go into the 1st homework assignment)
	F	Jan. 21		
3	M	Jan. 24		
	T	Jan. 25	**5. PART 2: Review of macroscopic electrodynamics**	Formal development of macroscopic electrodynamics: Macroscopic averaging Macroscopic charges, currents, and fields
	W	Jan. 26		
	R	Jan. 27	**6.**	The auxiliary ***D***, ***P***, ***H***, ***M*** fields Macroscopic Maxwell's equations Constitutive relations Boundary conditions at interfaces
	F	Jan. 28		
4	M	Jan. 31		
	T	Feb. 01	**7. PART 3: Electrostatics of ("perfect" metallic) conductors**	Maxwell's Equations Boundary conditions at interfaces
	W	Feb. 02		
	R	Feb. 03	**8.**	EXAMPLE: Conducting sphere in uniform ***E***-field
	F	Feb. 04		
5	M	Feb. 07		
	T	Feb. 08	**9. PART 4: Electrostatics of dielectrics**	Maxwell's Equations Boundary conditions at interfaces
	W	Feb. 09		
	R	Feb. 10	**10.**	"Refraction" of field lines at interface
	F	Feb. 11		
6	M	Feb. 14		
	T	Feb. 15	**11.**	EXAMPLE: Dielectric sphere in uniform ***E***-field
	W	Feb. 16		

	R	Feb. 17	**12. PART 5: Steady current in "polarizable" conductors**	Maxwell's Equations Boundary conditions at interfaces "Refraction" of ***j***-field lines at interface PROBLEM SOLVING
	F	Feb. 18		
7	M	Feb. 21		
	T	Feb. 22	**13. PART 6: Magnetostatics of magnetics**	Maxwell's Equations in magnetostatics Boundary conditions at interfaces
	W	Feb. 23		
	R	Feb. 24	**14.**	Diamagnetic response (demo) Linear isotropic magnetics "Refraction" of field lines at interface
	F	Feb. 25		
8	M	Feb. 28		
	T	Mar. 01	**15.**	Magnitudes of fields at the interface PROBLEM SOLVING
	W	Mar. 02		
	R	**Mar. 03**		**EXAM 1**
	F	Mar. 04		
9	M	Mar. 07		
	T	Mar. 08		
	W	Mar. 09		Spring Break
	R	Mar. 10		
	F	Mar. 11		
10	M	Mar. 14		
	T	Mar. 15	**16. PART 7: Energy in macroscopic electrodynamics**	Derivation of Poynting's Theorem
	W	Mar. 16		
	R	Mar. 17	**17.**	Thermodynamics of dielectrics (and magnetics)
	F	Mar. 18		
11	M	Mar. 21		
	T	Mar. 22	**18.**	The minimum principle and its applications
	W	Mar. 23		
	R	Mar. 24	**19. PART 8: Macroscopic electrodynamics with rapidly changing fields**	The Concept of Fourier Transform Fourier Images of Harmonically Oscillating Fields **Withdrawal deadline**
	F	Mar. 25		
12	M	Mar. 28		
	T	Mar. 29	**20.**	Temporal dispersion Experimental determination of susceptibility
	W	Mar. 30		
	R	Mar. 31	**21.**	General principles of theoretical modelling of media The Oscillator Model of non-polar dielectrics (intro)
	F	Apr. 01		
13	M	Apr. 04		
	T	Apr. 05	**22.**	The Oscillator Model of non-polar dielectrics (cont)
	W	Apr. 06		
	R	Apr. 07	**23.**	Permittivity in the Oscillator Model Frequency dispersion
	F	Apr. 08		
14	M	Apr. 11		
	T	Apr. 12	**24.**	The Physical Significance of $\varepsilon''(\omega)$ (imaginary part of permittivity) Dissipating vs anti-dissipating (lasing) media
	W	Apr. 13		
	R	Apr. 14	**25.**	The Concept of Group Velocity

	F	Apr. 15		
15	M	Apr. 18		
	T	**Apr. 19**		**EXAM 2**
	W	Apr. 20		
	R	Apr. 21	**26. PART 9: Electromagnetic waves in macroscopic electrodynamics**	Normal waves in nonmagnetic temporally dispersive media Dispersion relations Homogeneous vs non-homogeneous EM waves Index of refraction Connection between the ***E***- and ***B***-fields in a homogeneous wave
	F	Apr. 22		
16	M	Apr. 25		
	T	Apr. 26	**27.**	EM waves in plasma
	W	Apr. 27		
	R	Apr. 28	**28.**	Surface waves (surface plasmons)
	F	Apr. 29		
17	M	May 02		
	T	May 03	**29.**	Reflection and refraction at interfaces via Maxwell's theory (if time permits) **Classes End**
	W	May 04		**Reading Day**
	R	**May 05**		**Section 27364 FINAL EXAM: 08:00 - 11:00**
	F	May 06		
18	M	May 09		
	T	May 10		
	W	May 11		
	R	May 12		
	F	May 13		Commencement
19	**M**	**May 16**		**Grades due (12:00 PM)**
	T	May 17		

Spring 2022 Calendar
Based on 50 minute classes (MWF), 75 minute classes (TTH), 15 weeks of classes + Exams

Orientation / Advisement	Jan. 6	Thursday
Registration	Jan. 7	Friday
Classes Begin	Jan. 10	Monday
Drop / Add for undergraduate and graduate level courses	Jan. 10 - 14	Monday - Friday
Holiday: Martin Luther King Jr. Day	Jan. 17	Monday
Midterm	Mar. 3	Thursday
Last Day of Classes prior to Spring Break	Mar. 4	Friday
Spring Break	Mar. 7 - 11	Monday – Friday
Classes Resume	Mar. 14	Monday
Withdrawal Deadline	Mar. 24	Thursday
Classes End	May 3	Tuesday
Reading Day	May 4	Wednesday
Final Exams	May 5 - 11	Thursday - Wednesday
Commencement	May 13	Friday
Grades Due	May 16	Monday, 12 PM

Final Exam Schedule
Spring 2022

Monday/Wednesday/Friday Classes		**Tuesday/Thursday Classes**	
Meeting Time	**Exam**	**Meeting Time**	**Exam**
8:00 am	Mon., May 9 8:00 - 11:00 am	8:00 am	Tues., May 10 8:00 - 11:00 am
9:10 am	Wed., May 11 8:00 - 11:00 am	**9:35 am**	**Thur., May 5 8:00 - 11:00 am**
10:20 am	Fri., May 6 8:00 - 11:00 am	11:10 am	Tues., May 10 12:00 - 3:00 pm
11:30 am	Mon., May 9 12:00 - 3:00 pm	12:45 pm	Thur., May 5 12:00 - 3:00 pm
12:40 pm	Wed., May 11 12:00 - 3:00 pm	2:20 pm	Tues., May 10 3:30 - 6:30 pm
1:50 pm	Fri., May 6 12:00 - 3:00 pm	3:55 pm	Thur., May 5 3:30 - 6:30 pm
3:00 pm	Wed., May 11 3:30 - 6:30 pm	5:30 pm	Mon., May 9 7:00 - 10:00 pm
4:10 pm	Fri., May 6 3:30 – 6:30 pm	6:30 pm	Wed., May 11 7:00 - 10:00 pm
5:20 pm	Fri., May 6 3:30 - 6:30 pm	8:00 pm	Mon., May 9 7:00 - 10:00 pm
6:30 pm	Thur., May 5 7:00 - 10:00 pm	9:30 pm	Wed., May 11 7:00 - 10:00 pm

Mass Exam Schedule - Spring 2022

PHYS 1112, 1211, 1251, 1252	Mon., May 9 7:00 - 10:00 pm