ECGR3121 Introduction to Electromagnetic Fields

Course Lecturer

Jonathan Bird
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Official Office Hours: Wednesday 2-4pm

Lecture Room: EPIC 2222
Lecture Time: Monday and Wednesday, 9:30-10:45pm
Office: EPIC 2166

Course Recitation

Friday 12:30- 1:45, EPIC 2222.

Course Prerequisite

ECGR 2112 with a grade of C or better. Although it's not yet an official prerequisite, it would be best if you have already taken Math 2241 (Calculus 3).

Course Textbook

Nathan Ida , *Engineering Electromagnetics*, 2nd Edition, Springer, ISBN: 978-0-387-20156-6.

This syllabus includes a schedule of topics as we will discuss them. I strongly encourage you to read the material for a given lecture session prior to the session. Doing so will help you significantly in learning the material during class.

Reference Textbooks

D. K. Cheng, *Field and Wave Electromagnetics*, Addison-Wesley, 2nd Edition, 1989
D. J. Griffiths, *Introduction to Electrodynamics*, Prentice Hall, 3rd Edition, 1999

Grading

The final grade will be determined as follows:

Homework	10%
Test 1, Test 2	50%
Final Exam	40%

The final grades will never be worse than the following:

90% – 100%	A
80% – 89%	B
70% – 79%	C
60% – 69%	D
59% and below	F

at the end of the semester, I will likely adjust your final grades based on the class performance. Any final modification of your grades will only improve them and are non-negotiable.

Academic Dishonesty

All UNC Charlotte students have the responsibility to know, observe and enforce the requirements of *The UNC Charlotte Code of Student Academic Integrity* (*http://legal.uncc.edu/policies/up-407*). This Code forbids cheating, fabrication or falsification of information, multiple submissions of academic work, plagiarism, abuse of academic materials, and complicity in academic dishonesty. Also see http://integrity.uncc.edu .

Disability Services

It is University policy, on a flexible and individualized basis, to grant reasonable accommodations to students with disabilities that may affect their ability to participate in course activities or to meet course requirements. Students with disabilities are encouraged to contact their course instructor early in the semester to discuss their individual needs for accommodations. Please also provide a letter of accommodations from UNC Charlotte Disability Services (http://www.ds.uncc.edu).

Diversity Statement

Respect for cultural and human biological diversity are core concept at UNCC. In this course, each voice in the classroom has something of value to contribute to class discussion. Please respect the different experiences, beliefs and values expressed by your fellow students and instructor, and refrain from derogatory comments about other individuals, cultures, groups, or viewpoints. The Electrical and Computer Engineering Department supports the University of North Carolina at Charlotte's commitment to Diversity, and welcomes individuals of all ages, backgrounds, citizenships, disabilities, education, ethnicities, family statuses, genders, gender identities, geographical locations, languages, military experience, political views, races, religions, sexual orientations, socioeconomic statuses, and work experiences (See http://diversity.uncc.edu/).

Tentative Lecture Schedule

Date	Topics	Reading
18 Aug.	Vectors and Fields Introduction to Orthogonal Coordinates Cartesian Coordinates Cylindrical Coordinates	pp. 25–49
20 Aug.	Integrals of Vector Functions Gradient of a Scalar Field	pp. 58–85
22 Aug.	Divergence of a Vector Field Divergence Theorem Curl of a Vector Field, Stokes's Theorem	
25 Aug.	Vector Calculus Examples	
27 Aug.	Vector Identities Helmholtz's Theorem Laplacian of a Scalar Field Classification of Vector Fields	
29 Aug.	Fundamental Postulates of Electrostatics Coulomb's Law	pp. 126–132 pp. 173–177
1 Sep.	**Labor Day, No lecture**	
3 Sep.	Fundamental Postulates	
5 Sep.	Coulomb's Law: Discrete Charge Coulomb's Law: Continuous Charge Gauss' Law	pp. 132–155 pp. 178–189
8 Sep.	Electric Potential and Work Electrostatic Energy	pp. 190–206 pp. 244–259
10 Sep.	Coulomb's law, Gauss's Law, electric potential	
12 Sep.	Dielectrics in a Static Electric Field Electric Flux Density	pp. 206–223
15 Sep.	***No lecture (ECCE Conference)***	
17 Sep.	***No lecture (ECCE Conference)***	
19 Sep.	Electrostatic Boundary Conditions Conductors Capacitance	pp. 223–244
22 Sep.	*Buffer*	
24 Sep.	Current Density Ohm's Law	pp. 417–431
26 Sep.	Continuity and KCL Joule's Law Boundary Conditions on **J**, Resistance	pp. 431–441 pp. 447–452
29 Sep.	Current, Ω's law, BVP, Current and Ohm's law examples	
1 Oct.	**Exam I**	
3 Oct.	Fundamental Postulates of Magnetostatics Magnetic Vector Potential	pp. 470–473 pp. 494–506
6 Oct.	**Student Recess - No Class**	
8 Oct.	Biot–Savart Law	pp. 474–484
10 Oct.	Continuity, **J**'s law, BC's on **J**, R	

Date	Topics	Reading
13 Oct.	Scalar Magnetic Potential Lorentz Force Law Torque	pp. 526–532 pp. 604–607
15 Oct.	Faraday's Law of Induction	pp. 631–634
17 Oct.	Moving Conductor in a static Field Moving Conductor in a Time–Varying Field	pp. 634–652
20 Oct.	**No Lecture** (Nags Head conference)	
22 Oct.	Magnetic Dipoles Magnetization	pp. 507–508 pp. 532–543
24 Oct.	*Buffer*	
27 Oct.	Magnetic Circuits	pp. 584–591
29 Oct.	Inductance	pp. 557–572
31 Oct.	**Exam II**	
3 Nov.	Magnetic Energy	pp. 572–584
5 Nov.	Forces on Magnetic Materials Forces on Currents	pp. 591–604
7 Nov.	Maxwell's Equations	pp. 689–697
10 Nov.	Boundary value problems Method of Images Images: Line Charge	pp. 290–311
12 Nov.	Poisson's and Laplace's Equations Uniqueness Separation of Variables	pp. 282–290 pp. 326–329
15 Nov.	Fourier Series	
17 Nov.	Cartesian Boundary Value Problems	pp. 329–334
19 Nov.	**No lecture** (DOT conference)	
21 Nov.	Images, Separation of Variables, Partial Differential Equations	
24 Nov.	*Buffer*	
26 Nov.	**Thanksgiving break**	
28 Nov.	**Thanksgiving break**	
1 Dec.	*Buffer*	
3 Dec.	*Buffer – Last day of class*	
10 Dec.	**Final Exam** (8:00–10:30) ***– Double check date and time.***	