**Course Outline**

**PHYS 321 Electrodynamics (4 credits) Spring 2023**

Instructor Details:

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Office Hours: 11:00 pm – 01:00 pm (M,W, F)-S025

Class Timing: 11:00 am – 12:15 pm (T, R)-S016

Laboratory Timing: 2:00 pm – 3:50 pm (R)-S016B

**Course Goals:**

The Course Phys-321 is for ungraduate students. This is the core course. All students must take this course. The course will be offered during the spring semester.

**Course Objectives:**

It’s no exaggeration that we live in electromagnetic world. Out of four basic forces of nature which we experience three of them are electromagnetic in origin. It is a study of light, electric charges and magnetism. It lays the foundation of all the modern information age. All the current technologies such as both wired and wireless communications, sensing and transmission based on manipulation of electric and magnetic field.

The objectives of this course are to teach the laws of electromagnetism and their applications. Problems-solving techniques and critical thinking will be learned through homework problems and concept questions that will enable them to understand the importance of electromagnetic in the world around us. Each student will become more aware of his or her strengths and weaknesses in learning by working on a variety of skills. By examining their values and developing learning strategies this course will help students become successful in FCC’s liberal arts program.

# Learning Outcomes:

By the end of this course it is hoped that students will be able to

1. Understand and appreciate that most of the natural phenomena can be explained using fundamental concepts of mathematical physics.
2. Develop understanding of the material studied by solving applicable problems.
3. Become familiar with mathematical principles and techniques used in the field of physics.
4. To value the liberal arts including the general education.
5. To appreciate the importance of punctuality, being present and engaged in all online classes, meeting deadlines for assignments.
6. To take effective and efficient notes while listening to a lecture and reading a text.
7. To read on a topic from different sources and collate in own words what the authors are trying to convey.
8. To do his/her own work and exhibit principles of academic integrity, especially citing references appropriately.
9. To use the library effectively and efficiently to search for information in both print and electronic forms.
10. To set realistic goals for self and manage time appropriately.
11. To ask intelligent questions reflecting critical, creative, and analytical thinking.
12. To follow and live by the core values of the college at all times.
13. To make presentations that reflect major skills learned.

**Course content**:

**Maxwell’s Equations:** Maxwell Equations, Application of Maxwell's equations (The Continuity Equation, Poynting’s Vector, Maxwell’s Stress Tensor, and Conservation of Momentum**).**

**Electromagnetic (EM) Waves:** Wave Equation; Plane monochromatic EM wave in a vacuum;Non-conducting and nonmagnetic dielectric media; Propagation of EM waves; EM waves in bounded regions; Boundary Conditions; Reflection and Transmission; Absorption and Dispersion of EM Waves in conductors; The Frequency Dependence of Permittivity; Refraction and reflection at metal surface; Guided Waves; Parallel Plate waveguides; Rectangular Wave Guides; Drude-Lorentz harmonic oscillator model

**Potential Fields:** Scalar and Vector Potentials; Gauge Transformations; Coulomb Gauge and Lorentz Gauge; Retarded Scalar and Vector Potential; The Fields of an oscillating dipole

**Radiation:** Electric Dipole Radiation, Magnetic Dipole Radiation, Radiation from an Arbitrary Source, Power Radiated by a Point Charge.

**Relativistic Electrodynamics:** Special theory of Relativity, Covariant formulation of electric and magnetic fields; electromagnetic field tensor; Covariant formulation of Maxwell's equations

**Required texts:**

1. **Required texts:**

Introduction to Electrodynamics by David J. Griffiths (3rd ed.)

<https://b-ok.asia/book/5301342/f95bb4>

**Optional:**

2. Classical Electrodynamics by J.D. Jackson (3rd Edition), Wiley 1998. <http://www.fisica.unlp.edu.ar/materias/electrolicfismed/electromagnetismo-material-adicional/Jackson%20-%20Classical%20Electrodynamics%203rd%20edition.pdf/view>

3. Foundation of Electromagnetic Theory By Reitz, Milford, Christy (4th ed.) <https://b-ok.cc/book/705908/27d69f>

sty (4th ed.)

**Break up of marks/credits**  % credit/marks

Quizzes. 15

Assignments / tests / presentation/viva etc. 15

MID and Final 40

Attendance/participation 10

Laboratory 20

**Total 100**

**Detail weekly breakup of objectives with specific resources and assessment:**

|  |  |  |
| --- | --- | --- |
| Topics (weekwise) | **What’s the students should do** | Assessment |
| Electrodynamics  (week 1-week 3) | * Read topics (7.1,7.2,7.3) of chapter 7 from the text book of Griffiths (mandatory) * Go through the provided ppt slides * Attend the university classes * Watch the following videos for concern ‘s topic help:   <https://www.youtube.com/results?search_query=griffiths+electrodynamics+chapter+7>  <https://b-ok.asia/book/5301342/f95bb4> | * MCQs based Quiz * Viva * Assignment |
| Conservation Laws  (week 4-week 6) | * Read topics (8.1,8.2) of chapter 8 from the text book of Griffiths (mandatory) * Go through the provided ppt slides * Attend the university classes for each lecture * Watch the following videos for concern ‘s topic help:   <https://www.youtube.com/watch?v=_ggblMjsbVE&list=PLMcpDl1Pr-vjeXs4h7kmLJPD5w1cA0ajc&index=36>  <https://b-ok.asia/book/5301342/f95bb4> | * MCQs based Quiz * Viva * Assignment |
| EM waves  (week 7-week 10) | * Read topics (9.1,9.2,9.3,9.4) of chapter 9 from the text book of Griffiths (mandatory) * Go through the provided ppt slides * Attend university classes for each lecture * Watch the following video for concern ‘s topic help:   <https://www.youtube.com/results?search_query=griffiths+electrodynamics+chapter+8>  <https://b-ok.asia/book/5301342/f95bb4> | * MCQs based Quiz * Viva * Assignment |
| Potential and fields  (week 11-week 13) | * Read topics (10.1, 10.2) of chapter 10 from the text book of Griffiths (mandatory) * Go through the provided ppt slides * Attend the university class for each lecture * Watch the following video for concern ‘s topic help:   <https://www.youtube.com/watch?v=gc8NvnlMawY&t=45s>  <https://b-ok.asia/book/5301342/f95bb4> | * MCQs based Quiz * Viva * Assignment |
| Radiation & Revision  (week 14-week 16) | * Read topics (11.1) of chapter 11 from the text book of Griffiths (mandatory) * Go through the provided ppt slides * Attend the university classes for the lecture * Watch the following video for concern ‘s topic help:   <https://www.youtube.com/results?search_query=griffiths+electrodynamics+chapter+9+radiation>  <https://b-ok.asia/book/5301342/f95bb4> | * MCQs based Quiz * Viva * Assignment |
| Relativistic Electrodynamics & Revision  (week 14-week 16) | * Read topics (12.1,12.2) of chapter 12 from the text book of Griffiths (mandatory) * Go through the provided ppt slides * Attend the university classes for the lecture * Watch the following video for concern ‘s topic help:   <https://b-ok.asia/book/5301342/f95bb4> | * MCQs based Quiz * Viva * Assignment |

**Attendance and Grading Scale policy:**

Students must attend all the lectures. If attendance of any student falls below 70%, he/she will not be allowed to sit in the final exam. FCCU grading scale policy will be followed to calculate grades and quality points. There will be no makeup quiz or exam if you miss any except for medical reasons with doctor’s verification.

**Required Work:**

* Attend ALL classes. Arrive on time and stay the entire period.
* Read all assignments, perform all laboratory work, and submit all homework on time.
* Keep a neat Laboratory Notebook containing all course work.
* Take both exams.
* Explore, be attentive, interact - pose questions to each other and figure things out.

Note:

1. An assignment will be posted/given to the class fortnightly on the average.
2. Absences will be approved ONLY in the case of extenuating circumstances. Non-approved absences shall quickly erode your course grade.
3. **There are NO makeup exams**.

**Grading Scale:**

|  |  |  |  |
| --- | --- | --- | --- |
| **Grade** | Quality Pts | Numerical Value | Meaning |
| **A** | 4.00 | 93-100 | Superior |
| **A–** | 3.70 | 90-92 |
| **B+** | 3.30 | 87-89 | Good |
| **B** | 3.00 | 83-86 |
| **B–** | 2.70 | 80-82 |
| **C+** | 2.30 | 77-79 | Satisfactory |
| **C** | 2.00 | 73-76 |
| **C–** | **1.70** | **70-72** |
| **D+** | 1.30 | 67-69 | Pass |
| **D** | 1.00 | 60-66 |
| **F** | 0.00 | 59 or below | Fail |
| **WP/WF** | Not applied to CGPA | | |

**Note: All announcements would be shared on moodle; emails and their what’s app groups if they have any query or problem they may contact or request for extra meeting via email/skype/what’s app group etc**