Washtenaw Community College Comprehensive Report

PHY 222 Analytical Physics II
Effective Term: Spring/Summer 2018

Course Cover

Division: Math, Science and Engineering Tech
Department: Physical Sciences
Discipline: Physics
Course Number: 222
Org Number: 12340
Full Course Title: Analytical Physics II
Transcript Title: Analytical Physics II
Is Consultation with other department(s) required: No
Publish in the Following: College Catalog , Time Schedule , Web Page
Reason for Submission: Three Year Review / Assessment Report
Change Information:
Consultation with all departments affected by this course is required.
Rationale: Three year review
Proposed Start Semester: Spring/Summer 2018
Course Description: This course is the second part of a two-course sequence in calculus-based physics for students majoring in science and engineering. Students will cover the concepts of electricity, magnetism, light and modern physics. Laboratory exercises are included to assist students in understanding these topics and to develop skills in data analysis methods.

Course Credit Hours

Variable hours: No
Credits: 5
Lecture Hours: Instructor: 60 **Student:** 60
Lab: Instructor: 45 **Student:** 45
Clinical: Instructor: 0 **Student:** 0

Total Contact Hours: Instructor: 105 **Student:** 105
Repeatable for Credit: NO
Grading Methods: Letter Grades
Audit
Are lectures, labs, or clinicals offered as separate sections?: NO (same sections)

College-Level Reading and Writing

College-level Reading & Writing

College-Level Math

Requisites

Prerequisite
PHY 211 minimum grade "C"

General Education

MACRAO
MACRAO Science & Math

MACRAO Lab Science Course

General Education Area 4 - Natural Science

Assoc in Applied Sci - Area 4

Assoc in Science - Area 4

Assoc in Arts - Area 4

Michigan Transfer Agreement - MTA

MTA Lab Science

Request Course Transfer

Proposed For:

Central Michigan University
Eastern Michigan University
Ferris State University
Grand Valley State University
Lawrence Tech
Michigan State University
Oakland University
University of Detroit - Mercy
University of Michigan
Wayne State University
Western Michigan University

Student Learning Outcomes

1. Apply the appropriate physical principles to solve problems pertaining to electricity, magnetism, light and modern physics.

   Assessment 1

   Assessment Tool: Written exam
   Assessment Date: Winter 2018
   Assessment Cycle: Every Three Years
   Course section(s)/other population: All sections
   Number students to be assessed: Random selection of students from all sections
   How the assessment will be scored: Departmentally-developed rubric
   Standard of success to be used for this assessment: 75% of the students should achieve a score of 2.5 out of 4 or better per question.
   Who will score and analyze the data: Departmental faculty

2. Collect data, perform calculations and draw conclusions based on the results of the calculations.

   Assessment 1

   Assessment Tool: Laboratory reports
   Assessment Date: Winter 2018
   Assessment Cycle: Every Three Years
   Course section(s)/other population: All sections
   Number students to be assessed: Random selection of students from all sections
   How the assessment will be scored: Departmentally-developed rubric
   Standard of success to be used for this assessment: 75% of the students should achieve a score of 75% or higher
   Who will score and analyze the data: Departmental faculty

Course Objectives

1. Solve problems involving quantization of charge-units.
2. Solve problems using Coulomb's Law, calculation of forces between point charges.
3. Explain the concept of inverse square distance relationship compared to other possibilities and

reasons why inverse square relationships would be suspected.
4. Define the concepts of conductors and insulators.
5. Perform laboratory analysis of positive and negative charge, Van DeGraaff Generator and the electrophorus.
6. Explain the concepts of types of fields with examples from temperature versus scalar fields.
7. Solve problems involving calculation of E-field due to discrete point charges.
8. Solve problems involving calculation of E-field due to continuous charge distributions using the differential form of Coulomb's Law.
9. Perform laboratory analysis of the potential in the region around a simulated thunderstorm and plot the electric field in the region.
10. Describe the general concept of flux and see examples from other fields.
11. Explain the area vector and the definition of electric flux.
12. Solve problems involving electric flux.
13. Describe the Gauss' Law.
14. Solve problems using Gauss' Law to find the field and understand the importance of symmetry.
15. Solve problems using Gauss' Law to find the charge density in a region.
16. Explain the concepts of potential and potential energy and use gravitation as an example.
17. Solve problems involving calculating the potential from the field and vice versa.
18. Solve problems involving calculating potential from discrete point changes.
19. Solve problems involving calculating potential from continuous charge distributions.
20. Solve problems involving potential energy of discrete and continuous charge distributions.
21. Explain the concept of capacitance.
22. Solve problems using capacitance.
23. Solve problems involving capacitors in series and parallel.
24. Solve problems involving energy in capacitors.
25. Explain the concept of dielectrics.
26. Perform laboratory analysis of charging a capacitor and find capacitance experimentally.
27. Explain the concept of moving charges and electric current.
28. Solve problems involving resistance as the ration of voltage to current.
29. Solve problems using Ohm's Law.
30. Solve problems involving energy and power in electric circuits.
31. Solve problems involving single loop circuits.
32. Solve problems involving multi-loop circuits and Kirchoff's Laws.
33. Solve problems involving RC circuits.
34. Perform laboratory analysis of the RC circuit and an introductory work with an oscilloscope.
35. Describe the concepts of the magnetic field, right-hand rule for magnetism, magnetic poles and torque principle for galvanometers and motors.
36. Solve problems involving trajectories in the magnetic field energy.
37. Solve problems involving magnetic force on a current carrying conductor.
38. Solve problems involving torque on a current loop.
39. Perform lab analysis of magnetic fields, field around a wire and e/m tube.
40. Solve problems using Bio-Savant Law to calculate B-field due to various currents.
41. Solve problems using Ampere's Law used to calculate B-field due to various currents.
42. Solve problems involving calculation of B-field in solenoids and toroids.
43. Solve problems to calculate EMF involving force on a moving charge.
44. Solve problems calculating EMF involving time rate of change of magnetic flux.
45. Perform laboratory analysis of Farady's Law.
46. Describe the concept of inductance two ways: as the ratio of magnetic flux to the current that produced the flux and as the ratio of the EMF produced to the time rate of change of the current that caused it.
47. Solve problems involving the LR circuit.
48. Explain the comparison of the concepts of inductance and capacitance.

49. Solve problems involving energy and magnetic field and energy in an inductor.
50. Solve problems involving magnetic energy density.
51. Perform laboratory analysis of the inductance of a coil and examine the effect of adding iron to the coil.
52. Describe the concept of LC oscillations.
53. Solve problems regarding LC oscillations.
54. Explain the concept of LC oscillations and resonance.
55. Perform laboratory analysis of an R-C-L circuit resonance.
56. Solve problems involving the series LCR circuit.
57. Solve problems involving the transformer.
58. Discuss the Maxwell's equations to solve problems involving calculation of B-field due to changing E-flux.
59. Discuss the concept of symmetry in the equation.
60. Solve problems pertaining to Maxwell's equations.
61. Solve problems involving reflection and refraction, light considered as a wave.
62. Solve problems involving index of refraction and Snell's Law.
63. Solve problems using the thin lens formula.
64. Solve problems using ray tracing.
65. Solve problems involving polarization.
66. Perform laboratory analysis of the index of refraction of several different substances using both Snell's Law and Brewster's Law and the thin lens equation.
67. Solve problems involving two source interference involving sound, light and longer EM waves.
68. Solve problems involving intensity in two source interference, phasors.
69. Solve problems dealing with single-slit problem solving.
70. Solve problems involving a diffraction grating.
71. Solve problems of relativistic speeds.
72. Solve problems pertaining to time dilation.
73. Solve problems involving simultaneity.
74. Solve problems involving length contraction.
75. Solve problems involving relativistic kinetic energy.
76. Perform laboratory analysis of space-time graphs involving simultaneity, length contraction and twin paradox.

New Resources for Course

Course Textbooks/Resources

Textbooks

Halliday, Resnick, and Walker. *Fundamentals of Physics*, 10th ed. New York: John Wiley and Sons, 2014, ISBN: 9781118230732.

Manuals

Periodicals

Software

Equipment/Facilities

Level III classroom

Computer workstations/lab

TV/VCR

Data projector/computer

Other: Mechanical Universe videos

Reviewer	Action	Date
Faculty Preparer:		

Amir Fayaz	*Faculty Preparer*	*Oct 25, 2017*
Department Chair/Area Director:		
Kathleen Butcher	*Recommend Approval*	*Nov 21, 2017*
Dean:		
Kristin Good	*Recommend Approval*	*Nov 27, 2017*
Curriculum Committee Chair:		
David Wooten	*Recommend Approval*	*Jan 27, 2018*
Assessment Committee Chair:		
Michelle Garey	*Recommend Approval*	*Jan 29, 2018*
Vice President for Instruction:		
Kimberly Hurns	*Approve*	*Jan 30, 2018*