Physics 2220  Physics for Scientists & Engineers II  Summer 2019

University of Utah (4 semester units, meeting 13 May – 1 August, MWF, 8.00 – 9.15 a.m., JFB 103)

(Each student must also register for a discussion section, meeting Tu, Th 8.00 – 9.15 a.m.)

Instructor: Christopher Stone, Ph.D. (Associate Instructor)

Office: B-4 JFB, 801–585–9850

Office hours: MWF 9.45 – 10.45 a.m., or see me at the end of class in JFB 103, or by appointment at other times. (I live in Ogden and am on campus pretty much all day MWF, but usually not Tu.Th.) email: christopher.stone749@gmail.com or cstone@physics.utah.edu. Physics Dept: 201 JFB, 801–581–6901.

Secretary: Mary Ann Woolf, 205 JFB, 801–581–4246, woolf@physics.utah.edu

Course web page: www.physics.utah.edu/~woolf/2220_stone.html

Textbook: Physics for Scientists and Engineers (6th ed.), by Serway & Jewett (Thomson, Brooks/Cole, 2004). Since this is an older edition, relatively inexpensive copies can be bought from the University of Utah campus bookshop or through the internet. Also, a pdf copy of this book is available online for free.

Course Description:

We cover most of Chapters 23 – 38 of the textbook, some sections in more detail than others. The lectures will follow the book fairly closely, but supplementary information may also be discussed in class, and you will be held responsible for it as well as for textbook material on the examinations. Therefore, regular class attendance and participation are strongly encouraged.

There will be one or two WebAssign homework sets due each week (see page 4 for details). Each set of problems must be submitted by 11.59 p.m. of the day it is due. If you wish, you may work together on homework, provided that each person contributes to the solution and no one merely copies. You will probably learn more by discussing concepts and collaborating with others of about the same level as yourself than you would by simply working alone. Solutions will be available later on the WebAssign site, in addition to past examination problems for review on the course web page. For technical issues with WebAssign, please do not contact me but rather Doug Baird (doug.baird@utah.edu).

You should study your textbook and class notes carefully till the material makes sense to you. If you are still having trouble, talk to one of the discussion TAs – Jonah Barber, Matt Groesbeck, Rohit Kumar (the course marshal), David Ohlson – or to me. We shall be glad to help you. Please seek assistance as soon as you have a problem, so as not to fall behind in a subject that is unavoidably cumulative in nature. I urge you to read the relevant sections of your textbook at least once before we get to them in the lectures (and again afterwards), as we shall not have enough time to discuss in class all the textbook material that is relevant to the course. Also, feel free to ask questions or raise points of concern during the lectures. That way we can use our class time as efficiently as possible by concentrating on those parts of the subject that you find most difficult.

In addition to the final exam, there will be four examinations during the term (see pages 2 and 3 for dates and coverage). They will test you on both the information in the textbook and that discussed in class. You may fill both sides of one standard-size sheet of paper with notes and formulas to use during each exam. Your lowest exam score and the lowest three of your homework scores will be dropped when computing your total marks for the course. The final exam – which may not be dropped, and for which you may use two note sheets – will be on Thursday 1 August. It will be comprehensive, but weighted towards Chapters 35 – 38, which will not have been covered on the previous four exams. The total for the term will consist of 20 per cent (homework), plus 54 per cent (the sum of your best three ordinary exams), plus 26 per cent (final exam), for a total of 100 per cent.

After listing total scores in order for all members of the class, cutoff lines for grades will be decided by noting the natural gaps and groupings that nearly always occur. Based on past experience, the mean or median score typically corresponds to a grade of B –, and about 20 to 25 per cent of the class end up with grades in the A or A – range.
Summer 2019 Schedule for Physics 2220 Stone
(subject to change, with notice given in class)

Monday 13 May: Chapter 23 (Coulomb’s inverse-square law; the electric field, \( \mathbf{E} \), of discrete charges)
Wednesday 15 May: Chs 23 and 24 (electric fields of continuous charge distributions; electric flux)
Friday 17 May: Chapter 24 (Gauss’s law and some of its applications)

Monday 20 May: Chapter 25 (electrostatic potential energy, \( U \); electrostatic potential, \( V \))
Wednesday 22 May: Chapter 25 (calculating and using electric potential difference)
Friday 24 May: Chapter 26 (capacitance and capacitors; parallel and series connections)

Monday 27 May: Holiday (no classes held today)
Wednesday 29 May: Ch. 26 (energy in a charged capacitor; \( \mathbf{E} \)-field energy; capacitors with dielectrics)
Friday 31 May: **First Exam** (Chapters 23–25)

Monday 3 June: Ch. 27 (electric current, \( \mathbf{I} \); conductivity and resistivity; resistance, \( R \); electrical power)
Wednesday 5 June: Chapters 27 and 28 (emf, \( \mathbf{\varepsilon} \); resistors in series and parallel; Kirchoff’s rules)
Friday 7 June: Chapter 28 (using Kirchoff’s rules; RC circuits)

Monday 10 June: Chapters 28 and 29 (electrical meters; the magnetic field, \( \mathbf{B} \))
Wednesday 12 June: Chapter 29 (magnetic forces on moving charges and on currents; the Hall effect)
Friday 14 June: **Second Exam** (Chapters 26–28)

Monday 17 June: Ch. 30 (using the Biot-Savart law to calculate \( \mathbf{B} \); force between parallel conductors)
Wednesday 19 June: Chapter 30 (using Ampère’s law to calculate \( \mathbf{B} \); \( I_d \) and the Maxwell-Ampère law)
Friday 21 June: Chapter 31 (magnetic flux; Faraday’s law of induction; Lenz’s law, motional emf)

Monday 24 June: Chapter 31 (induced emf and electric fields; eddy currents; Maxwell’s equations)
Wednesday 26 June: Chapter 32 (self-inductance, \( L \), and mutual inductance, \( M \); RL circuits)
Friday 28 June: **Third Exam** (Chapters 29–31)
Monday 1 July:  Chapter 32  (magnetic field energy; oscillations in an LC circuit)

Wednesday 3 July:  Chapter 33  (AC sources and rms values; transformers and power transmission)

Friday 5 July:  Chapter 34  (brief vector calculus; Maxwell’s equations and electromagnetic (em) waves)

Monday 8 July:  Ch. 34  (the Poynting vector, \( \mathbf{S} \); properties of em waves: energy, momentum, pressure)

Wednesday 10 July:  Chapter 35  (ray optics; reflection; refraction and Snell’s law; Fermat’s principle)

Friday 12 July:  Chs 35 and 36  (total internal reflection; prisms; deviation, \( \delta \); dispersion; flat mirrors)

Monday 15 July:  Chapter 36  (image formed by refraction at a spherical surface; thin lenses)

Wednesday 17 July:  Chapter 36 and 37  (interference; Young’s double-slit experiment)

Friday 19 July:  **Fourth Exam** (Chapters 32–34)

Monday 22 July:  Chapter 37  (double-slit intensity; the phasor method; interference in thin films)

Wednesday 24 July:  Holiday (no classes held today)

Friday 26 July:  Chapters 37 and 38  (single-slit Fraunhofer diffraction; single-slit intensity)

Monday 29 July:  Chapter 38  (resolution; the diffraction grating; polarization of light)

Wednesday 31 July:  Revision for Final Exam

**Thursday** 1 August:  **Final Exam** (comprehensive), 7.30 – 9.45 a.m. in JFB 103

Beginning Wednesday 7 August, you may pick up your Final Exam paper from Mary Ann Woolf, in 205 JFB (801–581–4246). Be prepared to show some form of picture identification.

Course prerequisites:  Grade C – or better in Mathematics 1220 (or 1250, 1311, 1320, or 2210) **and** in Physics 2210 or 3210, or an AP Physics C Mechanics score of 4+. (It is very helpful, though not required, to have a knowledge of vector calculus such as is covered in the last part of Mathematics 2210.)

The University of Utah seeks to provide equal access to its programs, services, and activities for people with disabilities. If you will need accommodations in this class, reasonable prior notice needs to be given to the Center for Disability Services, 162 Olpin Union Building, 801-581-5020. CDS will work with you and the instructor to make arrangements for accommodations. All written information in this course can be made available in an alternative format with prior notification to the Center for Disability Services.

Personal concerns such as stress, anxiety, relationship difficulties, depression, cross-cultural differences, etc., can interfere with a student’s ability to succeed and thrive at the University of Utah. For helpful resources contact the Center for Student Wellness at www.wellness.utah.edu (or phone 801-581-7776).
## Homework Problems from *Physics* (sixth edition) by Serway and Jewett (on WebAssign):

<table>
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<tr>
<th>HW Set</th>
<th>Problems</th>
<th>Date Due</th>
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<td>Saturday 18 May</td>
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<td>Ch. 24: 4, 11, 16, 21, 57, 70, 72</td>
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<td>3</td>
<td>Ch. 25: 9, 14, 17, 28, 34, 38, 39</td>
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<td>4</td>
<td>Ch. 25: 43, 46</td>
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<td>Ch. 26: 5, 7, 11, 16, 17</td>
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<td>Ch. 26: 19, 27, 28, 50, 57, 61, 69</td>
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<td>Ch. 28: 4, 15, 24, 36, 47</td>
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<td>Ch. 28: 57</td>
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<td>Ch. 29: 10, 14, 22, 30, 45, 50</td>
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<td>Ch. 30: 6, 12, 15, 19, 22, 26, 29</td>
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<td>10</td>
<td>Ch. 30: 33, 38</td>
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<td>Ch. 31: 9, 10, 22, 28, 32</td>
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<td>13</td>
<td>Ch. 34: 1, 5, 7, 12, 14, 24, 25</td>
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<td>14</td>
<td>Ch. 34: 28, 31</td>
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<td>Ch. 35: 2, 9, 18, 20, 21</td>
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<td>15</td>
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<td>Ch. 36: 5, 13</td>
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<td>16</td>
<td>Ch. 36: 14, 16, 23, 38, 41, 62, 67</td>
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<td>17</td>
<td>Ch. 36: 72</td>
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<td>Ch. 37: 6, 13, 19, 31, 35, 37</td>
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<td>18</td>
<td>Ch. 37: 40, 52, 61</td>
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<td>Ch. 38: 2, 9, 18, 22</td>
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<td>19</td>
<td>Ch. 38: 24, 25, 26, 41, 42, 46, 49</td>
<td>Wednesday 31 July</td>
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Additional Practice Problems

Each WebAssign homework set comprises seven problems. To understand the course material more thoroughly, I suggest that you also do as many additional problems as you have time for. Here is a list of extra problems I especially recommend, and they will be available for you in WebAssign:

**Chapter 23**: 7, 11, 12, 22, 29, 31, 34, 35, 49

**Chapter 24**: 13, 19, 24, 26, 37, 43, 47, 51, 64, 67, 69

**Chapter 25**: 18, 35, 36, 41, 44, 47, 58, 67, 68, 71, 72

**Chapter 26**: 12, 14, 29, 30, 37, 41, 42, 47, 54, 64, 75

**Chapter 27**: 7, 11, 21, 27, 31, 72

**Chapter 28**: 1, 2, 6, 9, 16, 19, 21, 25, 37

**Chapter 29**: 4, 5, 17, 23, 28, 36, 49, 63

**Chapter 30**: 5, 17, 21, 36, 37, 55, 71, 72, 73

**Chapter 31**: 5, 6, 13, 17, 18, 21, 29, 50, 52, 58, 63, 64

**Chapter 32**: 5, 7, 12, 19, 26, 27, 36, 38, 39, 43, 52, 69, 71

**Chapter 33**: 1, 2, 3, 7, 45, 47, 48, 49

**Chapter 34**: 3, 6, 13, 15, 26, 27

**Chapter 35**: 12, 14, 33, 35, 38, 47, 49, 61, 66, 70, 71

**Chapter 36**: 3, 12, 17, 26, 27, 29, 31, 32, 63, 65, 68, 74, 77

**Chapter 37**: 1, 2, 5, 7, 17, 21, 22, 23, 32, 33, 34, 39, 48, 66

**Chapter 38**: 1, 3, 23, 27, 29, 31, 40, 43, 45, 55, 64, 68