

# PHY225 The Quantum Universe

Gustavus Adolphus College Spring 2019

**Instructor:** Dr. Steven Mellema

**Office:** Olin Hall 210

**Office Hours:** MTWRF 11:30AM-12:20 PM

**Phone/Voicemail:** 933-7306

**Email:** [mellema@gustavus.edu](mailto:mellema@gustavus.edu)

**Homepage:** <http://physics.gac.edu/~mellema/>

**Textbook:** *Modern Physics for Scientists and Engineers* (2nd Edition), by Taylor, Zafiratos and Dubson

## **Course Policy and Evaluation:**

1. **Class Meetings and Reading Assignments:** The class will meet five days a week from 10:30-11:20 am. Usually, four periods per week will be used for lecture, recitation or homework review. Class periods on the fifth day will be used for group problem-solving sessions or for exams. Attached is a daily calendar of all activities and reading assignments for the course. When reading assignments are made for a class session, the **reading is expected to be completed before coming to the class.**
2. **“Lectures”:** The lectures for this course **will not** be used simply to repeat material covered in the textbook. I will assume that each student is capable of reading and understanding the textbook, which has been chosen for its clarity and completeness of presentation. (Of course, questions about areas that were unclear when you read the textbook are always encouraged during class time!) Class time will be spent exploring in greater depth the concepts introduced in the textbook using demonstrations, discussion, and “Conceptests”. We will also devote time to examining and developing problem-solving techniques through additional worked examples.
3. **Pre-class, Online Reading Quizzes:** On each class day for which a reading assignment is given on the calendar, each student is required to take an online quiz to demonstrate that he/she has read and obtained a basic understanding of the material in the textbooks for the next lecture.

These quizzes will be conducted using the WebAssign program (accessible at [webassign.net](http://webassign.net)). The day’s reading quiz may be accessed at least 24 hours in advance, and **must be completed 15 minutes before class starts, i.e. at 10:15 am.**

When you registered at webassign.net for the Cosmic Universe course, you used the multi-term access code that came bundled with your Serway textbook. That code should still be valid, along the class key for this course: **gustavus 0023 0551**

Each student should self-enroll at [webassign.net](http://webassign.net) for the course PHY225-001 using that class key.

4. **Homework:** Homework problems will be due approximately once per week, and written solutions are due at the beginning of class on the assigned date. (See the complete list of homework assignment due dates in the calendar below.) Late homework may be accepted at the discretion of the instructor with a reduction in credit.
5. **Group Problem Solving:** Approximately once per week, students will work in assigned groups of three or four to solve difficult problems in a cooperative-learning setting. These sessions will require each group to submit a solution in a particular format, using the five-step physics problem-solving method previously taught. The entire group will receive one grade for their solution, with the grade depending on technique (adherence to the problem-solving method) as well as the answer.
6. **Attendance:** Regular attendance at all class meetings is expected. Students will be held responsible for informing themselves of all announcements/assignments made in class.
7. **Use of Electronic Devices in Class:** The use of cellular phones, tablets, and laptop computers during the lectures is prohibited. Exceptions may be made to accommodate student disabilities.
8. **Exams:** There will be four one-hour exams and a two-hour final exam. The date for each of the exams is given in the calendar below. Students must arrange in advance to take an exam at other than the scheduled time, and may do so only for a valid health or school-related reason.
9. **Evaluation :**

Homework	25%
Online Reading Quizzes	10%
Group Problem Solutions	10%
Hour Exams	10% each
<u>Final Exam</u>	<u>15%</u>
Total	100%

Assignment of final letter grades will be based upon the following guidelines:

	B+ = 86-90%	C+ = 74-78%	D+ = 62-66%
A = 94-100%	B = 82-86%	C = 70-74%	D = 58-62%
A- = 90-94%	B- = 78-82%	C- = 66-70%	

10. **Academic Honesty:** Having signed and agreed to abide by the College's Honor Code, students thereby pledge that, in all academic exercises, examinations, papers, and reports, they shall submit their own work. Footnotes, or some other acceptable form of citation must accompany any use of another's words or ideas. In the context of this course, students are expected to collaborate and to discuss their out-of-class assignments. However, submitting under one's own name work that is merely copied from another is a violation of the Honor Code. Full descriptions of the Academic Honesty Policy and the Honor Code can be found in the Academic Catalog (online at: [www.gustavus.edu/general\\_catalog/current/acainfo](http://www.gustavus.edu/general_catalog/current/acainfo)).
11. **Incompletes :** A grade of incomplete will only be given for work not completed due to circumstances beyond the control of the student.

12. **Alignment with MN Teacher Education Standards:** This course fulfills some of the requirements for a MN Teaching License. A list of these standards, and the content within this course can be found at <https://gustavus.edu/physics/Syllabi.php>

13. **Help for Multilingual Students:**

Support for English learners and multilingual students is available through the Academic Support Center's English Learning Specialist ([www.gustavus.edu/advising/](http://www.gustavus.edu/advising/)). The ELS can meet individually with students for tutoring in writing, consulting about academic tasks, and helping students connect with the College's support systems. When requested, the ELS can consult with faculty regarding effective classroom strategies for English learners and multilingual students. The ELS can provide students with a letter to a professor that explains and supports appropriate academic arrangements (e.g., additional time on tests, additional revisions for papers). Professors make decisions based on those recommendations at their own discretion. In addition, English learners and multilingual students can seek help from peer tutors in the Writing Center ([www.gustavus.edu/writingcenter/](http://www.gustavus.edu/writingcenter/)).

14. **Disability Services:**

Gustavus Adolphus College is committed to ensuring the full participation of all students in its programs. If you have a documented disability (or you think you may have a disability of any nature) and, as a result, need reasonable academic accommodation to participate in class, take tests or benefit from the College's services, then you should speak with the Disability Services staff, for a confidential discussion of your needs and appropriate plans. Course requirements cannot be waived, but reasonable accommodations may be provided based on disability documentation and course outcomes. Accommodations cannot be made retroactively; therefore, to maximize your academic success at Gustavus, please contact Disability Services as early as possible. Disability Services ([www.gustavus.edu/advising/disability/](http://www.gustavus.edu/advising/disability/)) is located in the Academic Support Center.

## February 2019

Sun	Mon	Tue	Wed	Thu	Fri	Sat
<b>10</b>	<b>11</b> Classes begin; Syllabus and Introduction  Sections 1.1-1.6	<b>12</b> Sections 1.7-1.9	<b>13</b> Sections 1.10-1.12	<b>14</b> Sections 1.13-1.14	<b>15</b> Group Problem: Relativistic Kinematics	<b>16</b>
<b>17</b>	<b>18</b> Sections 2.1-2.4  Chapter 1 Homework due	<b>19</b> Sections 2.5-2.7	<b>20</b> Sections 2.8-2.9	<b>21</b> Sections 2.10-2.11	<b>22</b> Group Problem: Relativistic Dynamics	<b>23</b>
<b>24</b>	<b>25</b> Sections 3.1-3.5  Chapter 2 Homework due	<b>26</b> Sections 3.6-3.9	<b>27</b> Sections 3.10-3.11	<b>28</b> Hour Exam #1 (Chapters 1-2)		

## March 2019

Sun	Mon	Tue	Wed	Thu	Fri	Sat
					<b>1</b> Sections 3.12-3.13	<b>2</b>
<b>3</b>	<b>4</b> Sections 4.1-4.5 <b>Chapter 3</b> <b>Homework due</b>	<b>5</b> Sections 4.6-4.7	<b>6</b> Sections 5.1-5.6	<b>7</b> Sections 5.7-5.10	<b>8</b> <b>Group Problem:</b> <b>Quantization</b>	<b>9</b>
<b>10</b>	<b>11</b> Sections 6.1-6.3 <b>Chapters 4-5</b> <b>Homework due</b>	<b>12</b> Sections 6.4-6.6	<b>13</b> Sections 6.7-6.8	<b>14</b> Sections 6.9-6.10	<b>15</b> <b>Group Problem:</b> <b>Matter Waves</b>	<b>16</b>
<b>17</b>	<b>18</b> Sections 7.1-7.5 <b>Chapter 6</b> <b>Homework due</b>	<b>19</b> Sections 7.6-7.7	<b>20</b> Sections 7.8-7.9	<b>21</b> Hour Exam #2 (Chapters 3-6)	<b>22</b> Sections 7.10-7.11	<b>23</b>
<b>24</b>	<b>25</b> Sections 8.1-8.3 <b>Chapter 7</b> <b>Homework due</b>	<b>26</b> Sections 8.4-8.5	<b>27</b> Sections 8.6-8.8	<b>28</b> Sections 8.9-8.10	<b>29</b> <b>Group Problem:</b> <b>Schrödinger</b> <b>Equation</b>	<b>30</b>
<b>31</b>						

## April 2019

	Mon	Tue	Wed	Thu	Fri	Sat
	<b>1</b> No Class – Spring Break	<b>2</b> No Class – Spring Break	<b>3</b> No Class – Spring Break	<b>4</b> No Class – Spring Break	<b>5</b> No Class – Spring Break	<b>6</b>
<b>7</b>	<b>8</b> Sections 9.1-9.5 <b>Chapter 8</b> <b>Homework due</b>	<b>9</b> Sections 9.6-9.8	<b>10</b> Sections 10.1-10.5	<b>11</b> Sections 10.6-10.9	<b>12</b> <b>Group Problem:</b> <b>Atomic Physics</b>	<b>13</b>
<b>14</b>	<b>15</b> Sections 11.1-11.4 <b>Chapters 9-10</b> <b>Homework due</b>	<b>16</b> Sections 11.5-11.6	<b>17</b> Sections 11.7-11.8	<b>18</b> Sections 11.9-11.10	<b>19</b> No Class – Easter Break	<b>20</b>
<b>21</b>	<b>22</b> No Class – Easter Break	<b>23</b> Sections 12.1-12.4 <b>Chapter 11</b> <b>Homework due</b>	<b>24</b> Sections 14.1-14.4	<b>25</b> Sections 14.7-14.8	<b>26</b> <b>Group Problem:</b> <b>Molecules and Solids</b>	<b>27</b>
<b>28</b>	<b>29</b> Hour Exam #3 (Chapters 7-11)	<b>30</b> Sections 16.1-16.4 <b>Chapters 12-14</b> <b>Homework due</b>				

## May 2019

Sun	Mon	Tue	Wed	Thu	Fri	Sat
			<b>1</b> Sections 16.5-16.7 (Mayday Schedule)	<b>2</b> Sections 16.8-16.9	<b>3</b> Sections 17.1-17.4	<b>4</b>
<b>5</b>	<b>6</b> Group Problem: Nuclear Structure	<b>7</b> Sections 17.5-17.6 Chapter 16 Homework due	<b>8</b> Sections 17.7-17.9	<b>9</b> Sections 17.10-17.11	<b>10</b> Sections 17.12-17.13	<b>11</b>
<b>12</b>	<b>13</b> Group Problem: Nuclear Reactions	<b>14</b> Sections 18.1-18.3 Chapter 17 Homework due	<b>15</b> Sections 18.4-18.7	<b>16</b> Sections 18.8-18.9	<b>17</b> Hour Exam #4 (Chap. 12-17)	<b>18</b>
<b>19</b>	<b>20</b> Sections 18.10-18.11	<b>21</b> Looking Back: The Cosmic Universe	<b>22</b> Looking Forward: Supersymmetry?	<b>23</b> No Class – Reading Day	<b>24</b>	<b>25</b>
<b>26</b>	<b>27</b> Final Exam 8-10am	<b>28</b>	<b>29</b>	<b>30</b>	<b>31</b>	