Fall 2021, Physics 3201

Instructor: Aleksandr Chernatynskiy
117 Physics
aleksandrc@mst.edu (~24 hours response time)
Help Session: 2-4 pm Monday, PHYS 202
Office Hours: By appointment, or feel free to stop by if the door (Phys 117) is open

Text: Classical Mechanics, J.R. Taylor

See also: H. Goldstein, “Classical Mechanics”; L. Landau and E. Lifshitz, “Mechanics”

Web: Canvas, https://umsystem.instructure.com/

Instruction: This class follows the “Flipped Classroom” approach, where you, the students, are responsible for studying prerecorded videos of the lectures before the class session. The lectures are available for download at the class website. In the class, the key points of the lecture will be highlighted, and you will be given an opportunity (greatly encouraged) to ask questions about the material covered. The interactive quiz (administered via kahoot.com) will follow thus a device with the wireless internet access, such as smartphone, is required. The quizzes will cover factual materials of the lectures and test basic understanding of that material. The reminder of the class session will be devoted to working through the homework and other exam-like problems with the immediate help and support of the instructor. The overall idea is to “flip” the lectures and the homework: lecture is done at home at your own pace, while application of this material (solving problems) is done in the class.

Grading:

<table>
<thead>
<tr>
<th>Assignment</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Homework (10 highest score assignments out of ~12)</td>
<td>15%</td>
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<tr>
<td>Quizzes you take</td>
<td>15%</td>
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<tr>
<td>Quiz you make</td>
<td>10%</td>
</tr>
<tr>
<td>Exam 1 (09/21)</td>
<td></td>
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<tr>
<td>Exam 2 (10/21)</td>
<td></td>
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<tr>
<td>Exam 3 (11/18)</td>
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<tr>
<td>Final (Comprehensive)</td>
<td>60%</td>
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</tbody>
</table>

The grade for the class consist of three elements: quizzes, homework and exams, as highlighted in the table above.

- For quizzes you take, the grade is the average grade of all your scores, including quizzes made by your classmates. It is thus essential to study the lecture material before the class in order to successfully score a sufficient grade on the quiz. Note, that it is impossible to get an “A” without a respectable quiz score. Some number of quizzes scores (~20%) will be dropped.
➢ For the quiz you make: you will create a quiz (see orange empty spot in the table below for available topics) working in a team of 2 people with 6 questions. Topics are first come-first serve.

➢ Assigned homework is to be submitted via CANVAS every week on the due date, late homework will not be accepted. For an honest attempt to solve the homework full credit will be given: Instructor will return the homework with the feedback. Attempting and turning in the homework is a must, if “A” is desired. Solutions will also be discussed during the class sessions.

➢ The hour exams will be given in class at the following anticipated dates: 1: 09/21, 2: 10/21 and 3: 11/18. The lowest grade on one of these exams will be dropped. The final will be comprehensive and undroppable.

➢ Exams will be 2 stage exams: 45 minutes for the individual portions and 30 minutes for the group portion. 80% of the grade comes from the individual part, 20% from the group. Group score will not reduce the individual scores of the group members.

➢ Every problem in the exam will be graded on the 10 point scale and the overall score adjusted to make up the percentage indicated in the table. Note, that incorrect units of the answer will result in an automatic 1 point deduction.

➢ After the first exam, I will have an individual meeting with everyone who would get “C” or lower on it in order to find a way for improvement.

Absolute Grading Scale: The grade cuts are (to four significant figures):

A for 89.50% of total possible points
B for 79.50% of total possible points
C for 69.50% of total possible points
D for 59.50% of total possible points
F for less than 59.50% of possible points

The grade cuts are absolute and will not be lowered. Points will not be added to a student’s grade to bring it above the cutoff.

Covid-19 contingency plan: If Missouri S&T will switch to remote teaching due to the ongoing pandemic, all class meetings will be held via ZOOM synchronously, and all assignments will continue as scheduled. Exams will similarly held via ZOOM and will require web-camera to show the work area for proctoring.

Statement about Copyright, FERPA, and Use of Video
It is vitally important that our classroom environment promote the respectful exchange of ideas. This entails being sensitive to the views and beliefs expressed during discussions whether in class or online. Please obtain instructor permission before recording any class activity. It is a violation of University of Missouri policy to distribute such recordings without authorization and the permission of all who are recorded. More information is provided online.

Accessibility and Accommodations
It is the university’s goal that learning experiences be as accessible as possible. If you anticipate or experience physical or academic barriers based on a disability, please contact Student Disability Services at (573) 341-6655, sdsmst@mst.edu, visit http://dss.mst.edu/ for information. You are also
encouraged to meet with Dr. Chernatynskiy early in the semester. You will need to request a letter from Disability Support Services verifying your disability and specifying the accommodation you need and give this to Dr. Chernatynskiy before accommodation can be arranged. **Testing accommodations require seven days' notice.**

**Student Honor Code and Academic Integrity**
- All students are expected to follow the [Honor Code](http://registrar.mst.edu/academicregs/index.html).
- Page 30 of the Student Academic Regulations handbook describes the student standard of conduct relative to the University of Missouri System's Collected Rules and Regulations section 200.010, and offers descriptions of academic dishonesty including cheating, plagiarism and sabotage ([http://registrar.mst.edu/academicregs/index.html](http://registrar.mst.edu/academicregs/index.html)), any of which will be reported to the Vice Provost for Academic Support.
- Other resources for students regarding academic integrity can be found online.

**Well-Being and UCARE** ([https://go.mst.edu/ucare-report](https://go.mst.edu/ucare-report))
Any of us may experience strained relationships, increased anxiety, feeling down, alcohol/drug misuse, decreased motivation, challenges with housing and food insecurity, etc. When your mental well-being is negatively impacted, you may struggle academically and personally. If you feel overwhelmed or need support, please make use of S&T’s confidential mental health services at no charge. If you are concerned about a friend or would like to consult with a Care Manager, please make a [UCARE referral](https://go.mst.edu/ucare-report) for support and assistance.

**Health and Well-Being Canvas Course.** ([https://umsystem.instructure.com/enroll/G3LY3G](https://umsystem.instructure.com/enroll/G3LY3G))
The Health and Well-Being Canvas Course offers the Miner Well-Being Certification Program, a semester-long certification where participants can engage with campus-wide services and initiatives and develop skills that contribute to personal well-being and student success. Students can enroll in the free course at any time.

**Nondiscrimination, Equity, and Title IX**
Missouri University of Science and Technology is committed to the safety and well-being of all members of its community, and to creating an environment free from discrimination and harassment.

The University does not discriminate on the basis of race, color, national origin, ancestry, religion, sex, pregnancy, sexual orientation, gender identity, gender expression, age, disability, protected veteran status, and any other status protected by applicable state or federal law. As used in this policy, the word “sex” is also inclusive of the term “gender.”

Additionally, US Federal Law Title IX states that no member of the university community shall, on the basis of sex, be excluded from participation in, or be denied benefits of, or be subjected to discrimination under any education program or activity. Violations of this law include sexual harassment, sexual assault, dating/domestic violence, and stalking.

In accordance with The Collected Rules and Regulations University of Missouri, Missouri S&T requires that all faculty and staff members report, to the Missouri S&T Equity Officer, any notice of discrimination disclosed through communication including but not limited to direct conversation, email, social media, classroom papers and homework exercises.
Missouri S&T’s Equity Officer and Title IX Coordinator is Chief Diversity Officer Anitra Rivera. Contact their office at (573) 341-6038; 203 Centennial Hall) to report violations of the university’s nondiscrimination polices, including Title IX. To learn more about resources and reporting options (confidential and non-confidential) available to Missouri S&T students, staff, and faculty, please visit http://titleix.mst.edu.

**Course assistance:** If you have a disability and anticipate needing accommodations in this course, you are encouraged to meet with Dr. Chernatynskiy early in the semester. You will need to request a letter from Disability Support Services (http://dss.mst.edu, 203 Norwood Hall, 341-6655, dss@mst.edu) verifying your disability and specifying the accommodation you need and give this to Dr. Chernatynskiy before accommodation can be arranged. **Testing accommodations require seven days notice.**
## Physical Mechanics Fall 2021 (Phys 3201)

### Course topics

<table>
<thead>
<tr>
<th>Lec #</th>
<th>Date</th>
<th>Topics/Reading material</th>
<th>Homework</th>
</tr>
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<tbody>
<tr>
<td>1</td>
<td>08/24</td>
<td>Math Primer: Essential math used in this course</td>
<td></td>
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<tr>
<td>2</td>
<td>08/26</td>
<td>Newtonian mechanics; motion with constant forces</td>
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<tr>
<td>3</td>
<td>08/31</td>
<td>Motion with variable forces</td>
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<tr>
<td>4</td>
<td>09/02</td>
<td>Momentum, Angular momentum, Conservation, Rockets</td>
<td># 1</td>
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<tr>
<td>5</td>
<td>09/07</td>
<td>Energy, Formal 1D solution</td>
<td>#2</td>
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<tr>
<td>6</td>
<td>09/09</td>
<td>Oscillations</td>
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<tr>
<td>7</td>
<td>09/14</td>
<td>Variational Calculus</td>
<td>#3</td>
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<tr>
<td>8</td>
<td>09/16</td>
<td>Lagrangian mechanics</td>
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<td></td>
<td>09/21</td>
<td>Exam 1</td>
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<tr>
<td>9</td>
<td>09/23</td>
<td>Lagrangian mechanics: Examples</td>
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<tr>
<td>10</td>
<td>09/28</td>
<td>Lagrangian with constrains</td>
<td>#4</td>
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<tr>
<td>11</td>
<td>09/30</td>
<td>Fall break: No class</td>
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<tr>
<td>12</td>
<td>10/05</td>
<td>Conservation laws in Lagrangian</td>
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<td>13</td>
<td>10/07</td>
<td>2-body problem</td>
<td>#5</td>
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<tr>
<td>14</td>
<td>10/12</td>
<td>Oscillations Revisited</td>
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<tr>
<td>15</td>
<td>10/14</td>
<td>Hamiltonian formulation of mechanics</td>
<td>#6</td>
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<td></td>
<td>10/19</td>
<td>Canonical transformations</td>
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<td></td>
<td>10/21</td>
<td>Exam 2</td>
<td></td>
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<tr>
<td>16</td>
<td>10/26</td>
<td>Rigid Body Dynamics I</td>
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<td>17</td>
<td>10/28</td>
<td>Rigid Body Dynamics II</td>
<td>#7</td>
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<tr>
<td>18</td>
<td>11/02</td>
<td>Rigid Body Dynamics III</td>
<td></td>
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<tr>
<td>19</td>
<td>11/04</td>
<td>Collision theory</td>
<td>#8</td>
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<tr>
<td>20</td>
<td>11/09</td>
<td>Rutherford scattering</td>
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<tr>
<td>21</td>
<td>11/11</td>
<td>Motion in Non-inertial Frames: Linear motion</td>
<td>#9</td>
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<tr>
<td>22</td>
<td>11/16</td>
<td>Motion in Non-inertial Frames: Rotational motion</td>
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<td>11/18</td>
<td>Exam 3</td>
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<td>11/23</td>
<td></td>
<td>Thanksgiving Break: No classes</td>
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<td>11/25</td>
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<tr>
<td>23</td>
<td>11/30</td>
<td>Relativity: Lorentz transformation</td>
<td>#10</td>
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<tr>
<td>24</td>
<td>12/02</td>
<td>Relativity: Spacetime</td>
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<tr>
<td>25</td>
<td>12/07</td>
<td>Relativity: Dynamics and Energy</td>
<td>#11</td>
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<tr>
<td>26</td>
<td>12/09</td>
<td>Relativity: The last one</td>
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<tr>
<td>12/14</td>
<td></td>
<td>Final Exam @ 7.30 am</td>
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