

**IWU Syllabus**  
**Summer II STEM Teach III**  
**7/9/18-9/2/19**  
**Online**

**PHYE-502:** Classical Mechanics

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## Course Description

This course focuses on Newtonian (non-relativistic) mechanics and its Lagrangian formulation with applications to the motions of particles in three dimensions, systems of particles, gravitation and orbits, rigid body rotations and small vibrations). Prerequisites: a bachelor's degree with a physics major or be state certified (in any state) to teach Physics at a secondary school level, and PHYE-501 or equivalent.

Note: This course is designed for those seeking the credentials required by many regional accrediting bodies in order to be able to teach advanced placement, concurrent early college, and community college Physics courses.

**Credit Hours:** 3

**Prerequisite Courses:** PHYE-501 or equivalent

**Prerequisite Skills and Knowledge:** A bachelor's degree with a physics major or be state certified (in any state) to teach Physics at a secondary school level, and PHYE-501 or equivalent. Undergraduate coursework must include calculus (through multivariate) and ordinary differential equations.

## Course Outcomes

**Upon successful completion of this course you will be able to:**

1. Apply Newton's Laws of Motion and the Universal Law of Gravitation to solve for the motions of particles, systems of particles, rigid objects and small oscillations.
2. Demonstrate the origin and application of conservation laws in the Newtonian context.
3. Develop the Lagrangian, Hamiltonian and Hamilton-Jacobi formulations of Newton's Laws.
4. Apply the Lagrangian and Hamiltonian formulations to solve problems for systems with holonomic constraints using generalized coordinates.
5. Translate between mathematical descriptions and experimentally observable behavior.
6. Solve systems of differential equations for motion numerically using technology (e.g. Mathematica, Maple).

## Course Textbook

Goldstein, H., Poole, C., & Safko, J. (2002). *Classical mechanics*. San Francisco: Addison Wesley.

Davies, P. C. (1984). *God and the new physics*. New York: Simon & Schuster.

Taylor, J. R. (2002). *Classical mechanics*. Sausalito, CA: University Science Books.

## Course Technology

Each student will receive a short-term site license for Mathematica Online. This is arranged through Indiana Wesleyan.

Problem sets will be required to be submitted as a PDF formatted using LaTeX. LaTeX is a free download for Mac, PC, and Linux. The .tex file for each problem set can be downloaded and completed. In the event there is difficulty with compiling a LaTeX document, scanned work may be submitted for partial credit.

## Grading Scale

Grade	Quality Points Per Credit	Percentage	Score
A	4.0	95% - 100%	950 – 1000
A-	3.7	92% - 94.9%	920 – 949
B+	3.3	89% - 91.9%	890 – 919
B	3.0	85% - 88.9%	850 – 889
B-	2.7	82% - 84.9%	820 – 849
C+	2.3	79% - 81.9%	790 – 819
C	2.0	75% - 78.9%	750 – 789
C-	1.7	72% - 74.9%	720 – 749
D+	1.3	69% - 71.9%	690 – 719
D	1.0	65% - 68.9%	650 – 689
F	0	0% - 64.9%	0 – 649

## Grading Policies

Your grading policy for your course is dependent on your school and program. Your grading policies can be found in the IWU Catalog.

## Letter Grade Equivalencies

Grade	Description of Work
<b>A</b>	Clearly stands out as excellent performance. Has unusually sharp insights into material and initiates thoughtful questions. Sees many sides of an issue. Articulates well and writes logically and clearly. Integrates ideas previously learned from this and other disciplines. Anticipates next steps in progression of ideas. Example "A" work should be of such nature that it could be put on reserve for all cohort members to review and emulate. The "A" cohort member is, in fact, an example for others to follow.
<b>B</b>	Demonstrates a solid comprehension of the subject matter and always accomplishes all course requirements. Serves as an active participant and listener. Communicates orally and in writing at an acceptable level for the degree program. Work shows intuition and creativity. Example "B" work indicates good quality of performance and is given in recognition for solid work; a "B" should be considered a good grade and awarded to those who submit assignments of quality less than the exemplary work described above.
<b>C</b>	Quality and quantity of work in and out of class is average. Has marginal comprehension, communication skills, or initiative. Requirements of the assignments are addressed at least minimally.
<b>D</b>	Quality and quantity of work is below average. Has minimal comprehension, communication skills, or initiative. Requirements of the assignments are addressed at below acceptable levels.
<b>F</b>	Quality and quantity of work is unacceptable and does not qualify the student to progress to a more advanced level of work.

## Course Summary

Workshop	Devotional / Science Philosophy Discussion	Practical Applications Discussion	Concepts Quiz	Problem Set (Includes a Mathematica Component)	Total Points
Module One: Newton's Laws of Motion	25	35	40	100	200

Module Two: Particle Motion	25	35	40	100	200
Module Three: Central Force	25	35	40	100	200
Module Four: Gravitation	25	35	40	100	200
Module Five: Oscillations	25	35	40	100	200
Module Six: Lagrangians	25	35	40	100	200
Module Seven: Lagrangians	25	35	40	100	200
Module Eight: Hamilton Formulation	25	35	40	100	200
<b>Course Totals</b>	200	280	320	800	<b>1600</b>

Number of Activities/Sum Point Totals

### Course Development Resources

List each textbook with APA 6th edition formatting, double spaced with hanging indent.

## IWU DIVERSITY STATEMENT

IWU, in covenant with God’s reconciling work and in accordance with the Biblical principles of our historic Wesleyan tradition, commits to build a community that reflects Kingdom diversity. We will foster an intentional environment for living, teaching and learning, which exhibits honor, respect, and dignity. Acknowledging visible or invisible differences, our community authentically values each member’s earthly and eternal worth. We refute ignorance and isolation and embrace deliberate and courageous engagement that exhibits Christ’s commandment to love all humankind.