# CU Modern Physics Curriculum

Indicates a research-demonstrated benefit

## Overview

Curriculum for a large-lecture modern physics course for engineering majors, with an emphasis on reasoning development, model building, and connections to real world applications. Includes lecture presentations, clicker questions, homework, exam questions, PhET simulations, learning goals and suggestions for addressing common student difficulties. Course development is based on interviews with physics and engineering professors, observations and discussions with students, and previous research.

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| **Type of Method** | Full curriculum, Curriculum supplement, Tutorials, Computer simulations |
| **Level** | **Designed for:** Intermediate Undergraduate<br>**Can be adapted for:** Teacher Preparation, Teacher Professional Development, High School, Intro College Calculus-based, Intro College Algebra-based, Intro College Conceptual, Advanced Undergraduate, Graduate |
| **Setting** | **Designed for:** Lecture - Large (30+ students) , Homework<br>**Can be adapted for:** Lecture - Small (<30 students), Recitation/Discussion Session, Lab, Studio |
| **Coverage** | Many topics with less depth |
| **Topics** | Modern / Quantum |
| **Instructor Effort** | Medium |
| **Resource Needs** | Projector in class, Computers for student use outside of class |
| **Skills** | **Designed for:** Conceptual understanding of physics content , Understanding how physics relates to the real world , Problem-solving skills, Connecting conceptual and mathematical understanding, Representing knowledge in multiple ways<br>**Can be adapted for:** Coherent framework for physics, Think like a scientist, Reflecting on one's own learning, Self-confidence around physics, Enjoyment of physics, Laboratory skills |

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| **Research Validation** | **Based on research into:** how students learn , student ideas about specific topics<br>**Demonstrated to improve:** scores on multiple choice conceptual tests , scores on written conceptual tests , beliefs about physics<br>**Studied using:** conceptual pre/post exams , beliefs pre/post exams , student interviews , classroom observations |
| **Compatible Methods** | Peer Instruction, PhET, JiTT, CGPS, Physlets, SCALE-UP, OSP, LA Program, CAE TPS, New Model Course, CPU, TEFA, CU QM, QuILTs, PI QM, Tutorials, Clickers, Thinking Problems, Paradigms |
| **Similar Methods** | New Model Course, CU E&M, CU QM |
| **Developer(s)** | Carl Wieman, Kathy Perkins, Sam McKagan |
| **Website** | http://per.colorado.edu/modern |
| **Intro Article** | 5247 |
| **Intro Article** | Reforming a large lecture modern physics course for engineering majors using a PER-based design |