



# Free Online Mechanics Course using LON-CAPA: Enrollment Starts Now!



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## Abstract

We have used our Integrated Learning Environment for Mechanics (ILEM) as a basis for a free online mechanics course within the LON-CAPA course management system. ILEM integrates instruction (via an e-text and course videos) and assessment, for which new research-based problems involving multiple concepts have been added to the central collection of multi-level research-based homework sets organized by topic. Unique tools for instructors and students are also being developed that streamline access to ~ 480,000 resources from across the LON-CAPA network. Students evaluations in our course will be based on skill and participation, measured using Item Response Theory and other analytics. Users and collaborators are invited to participate in our free online course this Spring (February 2012).

## Free Online Course - Spring 2012

- Content and assessment items based on our MAPS Pedagogy
- Separate student evaluations based on skill and participation
- Enrollment begins February 2012 ~ [relate.mit.edu/physicscourse](http://relate.mit.edu/physicscourse)

The screenshot shows the 'Course Contents' page for the 'Online Mechanics Course'. It includes a navigation bar with 'Main Menu', 'Return to Last Location', and 'Course Contents'. Below, there is a 'Tools' section and a 'Syllabus' section with a tree view of course items: Introduction to the course, Professor Pritchard Video: Introduction to MAPS, Unit 1: Newton's Laws, Unit 1 Homework, Quiz 1, Professor Pritchard Video: How to draw free body diagrams: A Static Block, Professor Pritchard Video: How to draw free body diagrams: A block on accelerating plank, Unit 2: Interactions and Forces, Unit 2 Homework: Interactions and Force, Quiz 2, Unit 3: Applying Newton's Laws, Unit 3 Homework: Applying Newton's Laws, and Quiz 3. Each video item has a status of 'Open, no due date'.



The LearningOnline Network with CAPA

## Open-Source Mechanics Course

Units currently feature:

- 5-6 E-text Modules
- Worked Examples within E-text
- Checkpoint Questions
- Research-Based Multi-Level Homework
- Videos Introducing Content and Pedagogy
- MAPS - Applied to Problem Solving

To be implemented:

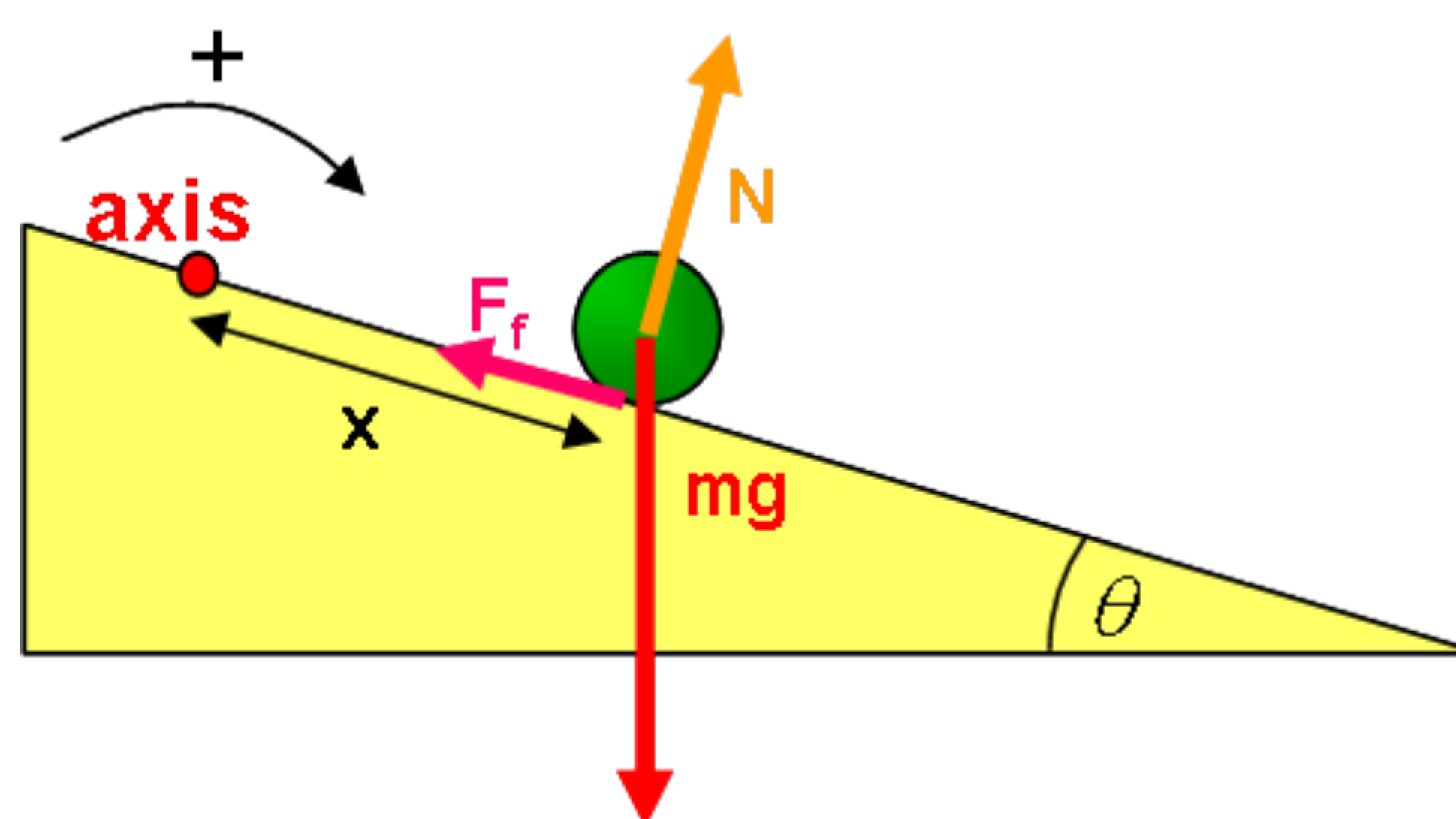
- Skill Based Assessment using Item Response Theory
- Efficiency Based Assessment using Time-based Analytics

## Current Mechanics Units

- Newton's Laws
- Interactions and Forces
- Applying Newton's Laws
- Describing Motion
- Momentum and Multi-body System
- Mechanical Energy and Work
- Rigid Bodies and Torque
- Describing Angular Motion
- Angular Momentum
- Simple Harmonic Motion
- Orbits

## Problem Characteristics

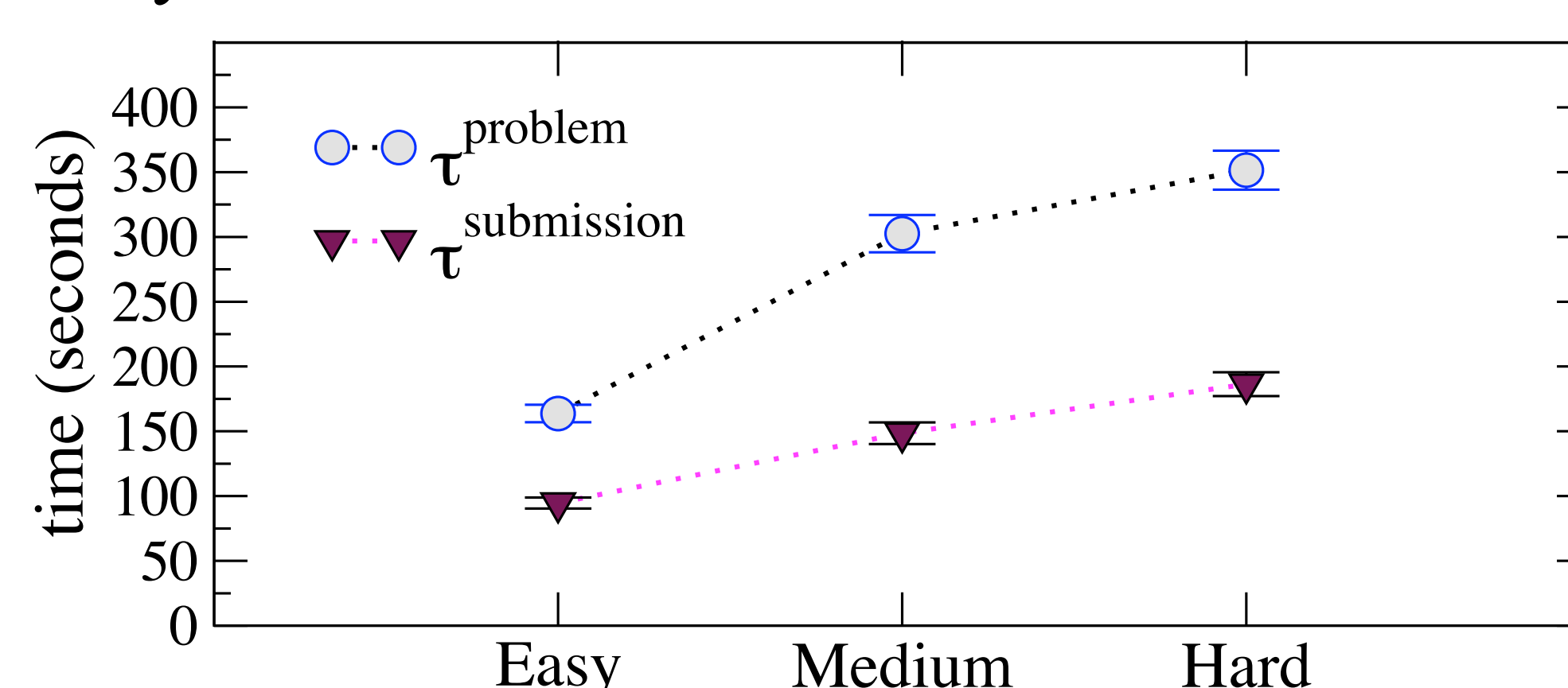
Problems involving multiple concepts are an important aspect of ILEM. The problem below combines translational and rotational dynamics.



A circular object of mass  $m$ , moment of inertia  $I$ , and radius  $R$ , rolls down an incline with coefficient of friction  $\mu$ . What is the maximum angle of the incline such that the object rolls without slipping?

Submit Answer Tries 0/99

End of unit assessment employs multi-level homework problems, where students choose to work easy (+1), medium (+2), or hard (+3) problems (above problem is considered hard), with the requirement of earning at least 15 point per unit. In analyzing our problem categorization, we have shown that time based measures provide an accurate measure of overall difficulty. Analyzing student behavior within the Spring 2011 implementation of our course has provided insight into student choice of problems, overall effort, and efficiency across the N~60 student population. See our talk FCO4 on Wednesday for more information on student and problem analytics.



## LON-CAPA

Content Sharing via Recommendation and Search

- LON-CAPA provides instructors access to one of the world largest shared repositories of educational content (~480,000 resources).
- Search features will allow instructors to filter materials across the network; for which there are ~ 60,000 physics problems.
- Recommender tools are being developed to aid instructors in understanding what resources are best suited for their courses; recommendations informed by overall use statistics.
- Quality ratings for searched and recommended items based on student performance (Item Response Theory and other analytics).

Clicker Integration

- A clicker question interface in LON-CAPA is being implemented.
- Sharing concept questions.
- Sharing question statistics.
- Streamlining question delivery and grading.

Resource and Student Assessment

- Item Response Theory - providing measures of both resource difficulty and student skill independent of which problems students work.
- Multi-dimensional IRT that allows assessment of multiple skills is being tested.
- Data mining focused on time-based behaviors within a course.

Visit FCO4 to see analytics from previous ILEM courses

We welcome users and collaborators



## Acknowledgements



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