1. **PHYS 17200 – Modern Mechanics**

2. **Credits and contact hours:**
   4 credits
   Lecture – 2 days per week at 75 minutes for 15 weeks.
   Lab - 1 day per week at 110 minutes for 15 weeks.

3. **Instructor's or course coordinator's name:** Andrew S. Hirsch, Amy J. Kingma, Kiranmayi Dattatreya Dixit, Teng Bian, Stylianos Gregoriou …

4. **Textbook(s):** *Matter & Interaction (Expert TA),* Chabay & Sherwood, Wiley & Sons, 4th edition, ISBN 9781118914496 (Notes-This is for the Phys 172-ScaleUp Course only. Will need (Expert TA). Purchase on-line. Any questions, please contact the instructor, Prof. Hirsch. Phys 172 mail –ScaleUp Course does NOT use WileyPlus.) Note: One or more linked sections for this course has materials associated. Please review the linked section to get the materials for that section.
   a. **Other supplemental materials:** None

5. **Specific course information**
   a. **Catalog description:** Introductory calculus-based physics course using fundamental interactions between atoms to describe Newtonian mechanics, conservation laws, energy quantization, entropy, the kinetic theory of gases, and related topics in mechanics and thermodynamics. Emphasis is on using only a few fundamental principles to describe physical phenomena extending from nuclei to galaxies. 3-D graphical simulations and numerical problem solving by computer are employed by the student from the very beginning. Typically offered Fall Spring Summer. CTL:IPS 1753 Calculus-based Physics I.
   b. **Prerequisites or co-requisites:** ((MA 16100 Minimum Grade of D- [may be taken concurrently] or MA 16300 Minimum Grade of D- [may be taken concurrently] or MA 16700 Minimum Grade of D- [may be taken concurrently] or MATH 16300 Minimum Grade of D- [may be taken concurrently] or MA 16500 Minimum Grade of D- [may be taken concurrently]) or ((MA 23100 Minimum Grade of D- [may be taken concurrently] or MA 22100 Minimum Grade of D- [may be taken concurrently] or MA 16010 Minimum Grade of D- or MATH 23100 Minimum Grade of D- [may be taken concurrently] or MA 22300 Minimum Grade of D- [may be taken concurrently]) and (MA 23200 Minimum Grade of D- [may be taken concurrently] or MA 22200 Minimum Grade of D- [may be taken concurrently] or MA 16020 Minimum Grade of D- [may be taken concurrently] or MATH 23200 Minimum Grade of D- [may be taken concurrently] or MA 22400 Minimum Grade of D- [may be taken concurrently])) or

MATH 16500 Minimum Grade of D- [may be taken concurrently] or ALEKS Math Assessment 085) or SAT Mathematics 650 or ACT Math 29 or SATR Math 670

c. **Course status:**

6. **Specific goals for the course**
   a. **Student Learning Outcomes:**
      1. Understand and describe a wide range of physical phenomena in mechanics and thermodynamics using only a few fundamental principles of physics.
      2. Learn a unified approach that relates microscopic behavior to macroscopic behavior.
      3. Model natural phenomena quantitatively.
      4. Apply all this to a range of topics related to mechanics and thermodynamics.
   b. **Relationship of course to program outcomes:**

7. **Topics**

Weeks	
1	Matter & Interactions, Momentum & Position Update, Newton's First Law of Motion, Familiarization with the Experimental Environment
2	The Momentum Principle, Momentum Principle & Predicting Motion, Velocity Vectors, Position, Velocity & Acceleration
3	Fundamental Interactions, Fundamental Interactions & Models of Solids, Predicting Motion, Changing Momentum. Measuring velocity and force.
4	Sound & Pressure, Rate of Change of Momentum I, Multiparticle Systems, Macroscopic springs. Harmonic Oscillator
5	Rate of Change of Momentum II, The Energy Principle, Change of Momentum, Static and Sliding (Kinetic) Friction
6	The Energy Principle, Energy Principle I
7	Potential Energy, Internal Energy, Energy Principle II, Bouncing Ball: Energy Analysis
8	Open vs. Closed Systems, Friction, Multiparticle Energy Principle I, Air Resistance: Falling Coffee Filters
9	Multiparticle Systems I & II, Multiparticle Energy Principle II, Energy of a Harmonic Oscillator
10	Multiparticle Systems III, Collison and Scattering, Systems with Internal Energy, Real & Point Particle Systems, Engineering Challenge Problem 1
11	Collision & Scattering, Collisions
12	Angular Momentum, Angular Momentum with zero Torque, The Angular Momentum Principle I, Objects Rolling: Moment of Inertia
13	Angular Momentum with Non-Zero Torque, The Angular Momentum Principle II, Conservation of Angular Momentum
14	Energy Quantization, Applying all Three Principles I
15	Applying all Three Principles II, Engineering Challenge Problem 2