NS 540 Concepts in Physics I: Force and Motion
Course Schedule

N.B.: The schedule below has not yet been adapted to the blended schedule of online and in-class meetings. Course readings may vary between course offerings.

Session 1: Describing motion
  Sections from Cutnell & Johnson: Sections 2.1, 2.2, 2.7
  Activities: Motion worksheet; Lab activity – Position, Velocity, and Acceleration
  History/Philosophy Activities: Introduction to Aristotle’s theory of motion. Discussion of excerpts of his Physics.
  Assignments for next session:
  WebAssign: Assignment 1

Session 2: Motion with constant acceleration
  Sections from Cutnell & Johnson: Sections 2.3 – 2.8
  Active Physics: Sports, Chapter 1, Activity 5 – Acceleration
  Activities: Lab activity – Motion with Constant Acceleration
  Assignments for next session:

Session 3: Forces in 1-Dimension
  Sections from Cutnell & Johnson: Sections 4.1 – 4.8; 4.10
  Activities: Lab activity – Forces between Carts; Newton’s Laws; Free-body diagrams
  History/Philosophy Activities: Class discussion on assigned reading ‘The premature synthesis’. Discussion of Zeno’s paradoxes and Aristotle’s response to this conceptual challenge to motion.
  Assignments for next session:
  WebAssign: Assignment 2

Session 4: Motion in Two Dimensions
  Sections from Cutnell & Johnson: Sections 1.5 – 1.9; Sections 3.1 – 3.3
  Active Physics: Sports, Chapter 1, Activity 8 – Projectile Motion
  Activities: Vectors and vector addition; Independence of X and Y
  Assignments for next session:
Session 5: Projectile Motion

Test 1: One hour.
Sections from Cutnell & Johnson: Sections 3.5
Activities: Analyzing projectile motion; Monkey/hunter; Lab activity – Projectile Motion
History/Philosophy Activities: Group and class discussion on Galileo’s understanding of acceleration in his Dialogues. A comparison of Aristotle’s, Galileo’s and Newton’s understanding of force.
Assignments for next session:
WebAssign: Assignment 3

Session 6: Forces in 2-Dimensions
Sections from Cutnell & Johnson: Sections 4.9; 4.11 – 4.13
Activities: Friction; Free-body diagrams; Applying Newton’s Second Law
Assignments for next session:
  
Session 7: Relative Velocity; Review
Sections from Cutnell & Johnson: Section 3.3
Activities: Relative velocity in 1-D; Relative velocity in 2-D; Review force concepts
History/Philosophy Activities: Group and class discussion on projectile motion contrasting Aristotle’s, Galileo’s and Newton’s accounts.
Assignments for next session:
WebAssign: Assignment 4

Session 8: Beyond Force
Sections from Cutnell & Johnson: Section 7.1; 6.1 – 6.4
Activities: Impulse; Work and Kinetic Energy; Lab activity – Energy and Work
Assignments for next session:
Summaries of two papers
  
Session 9: Momentum Conservation

Test 2: One hour.

Sections from Cutnell & Johnson: Section 7.2 – 7.6
Active Physics: Sports, Chapter 2, Activity 7 – Collisions
Activities: Momentum conservation; collisions

Science Education Research Activity: overview; group and class discussion on the assigned Halloun & Hestenes and Clement articles.

Assignments for next session:
WebAssign: Assignment 5
Due before next session: Participate in on-line discussion of the papers selected for preparing your curriculum design project or literature review project:
On motion in 1-D (these are short and related):

On other misconceptions in mechanics:

Session 10: Energy

Sections from Cutnell & Johnson: Sections 6.5 – 6.8
Activities: Lab activity – Collisions.
Assignments for next session:
Continue reading papers for projects.

Session 11: Energy Conservation

Sections from Cutnell & Johnson: Section 6.10
Active Physics: Sports, Chapter 1, Activity 10 – Pole Vault
Activities: Springs, Hooke’s Law, Elastic Potential Energy; Energy Conservation

Science Education Research Activity: Work in pairs planning culminating projects.

Assignments for next session:
WebAssign: Assignment 6

Session 12: Combining Momentum and Energy

Sections from Cutnell & Johnson: Sections 7.3, 7.6
Activities: Ballistic pendulum-type situations; Comparing analysis methods

Science Education Research Activity: Students’ presentations
Session 13

**Test 3:** One hour.

**Cumulative Take home examination.**

**Science Education Research Activity:** Students’ presentations.

Hand in journals.

Course debriefing.

Course evaluations.

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**Bibliography**

**Selections from primary sources**


**Selections from secondary sources**


**Selections from Physics Education Research Literature**


