Physics 2305 21 January, 2000
Study Guide for Exam I

The exam will consist of two parts. The multiple choice section will represent about 70% of your grade and include roughly 10 problems. The free-form section will cover the remaining 30% with about 3 problems. Partial credit will be awarded only on the free-form questions, and then only for *clear and legible* work.

Chapter 1

The key points in Ch. 1 are:

- uncertainty, significant figures, and error bars
- standard units
- unit conversions (the "1 =" method)

Any of these might appear on the exam.

Chapter 2

Velocity defined: $v = dx/dt$

Acceleration defined: $a = dv/dt$

From these and a little calculus, you should be able to derive the three kinematic equations for the special case of constant acceleration:

$$x = \tfrac{1}{2}\, a\, t^2 + v_o\, t + x_o$$

$$v = v_o + a\, t$$

$$v^2 = v_o^2 + 2\, a\, (x - x_o)$$

For the case of vertical motion with constant gravitational acceleration (g):

$$y = -\tfrac{1}{2}\, g\, t^2 + v_o\, t + y_o$$

$$v = v_o - g\, t$$

$$v^2 = v_o^2 - 2\, g\, (y - y_o)$$

Chapter 3

You should know how to perform the following vector operations:

- addition and subtraction
- scalar multiplication
- dot and cross product

You should also be able to separate a vector into its components in an arbitrary coordinate system and do the opposite, i.e. determine the magnitude and direction of a vector given its components.

Chapter 4

You should also be able to convert the three kinematic equations derived in Ch. 2 for the case of projectile motion in two dimensions:

$$x = v_{ox}\, t + x_o \qquad y = -\tfrac{1}{2}\, g\, t^2 + v_{oy}\, t + y_o$$

$$v_x = v_{ox} \qquad v_y = v_{oy} - g\, t$$

$$v_y^2 = v_{oy}^2 - 2\, g\, (y - y_o)$$

For the special case where $y=y_o=0$, you should be able to derive the range equation:

$$R = v_o^2 \sin 2\theta_o \,/\, g$$

Chapters 5 and 6

You should have Newton's Three Laws of Motion memorized, and you should know how to apply them. Newton's Second Law will be on the equation sheet, but this should be very familiar:

$$\Sigma\, \mathbf{F} = m\, \mathbf{a}$$

For dynamics problems, remember to:

(1) Draw a free-body diagram for each object;
(2) Pick a good coordinate system (with one axis in the direction of **a**);
(3) Apply Newton's Second Law to obtain the equations of motion;
(4) Apply the various constraints if needed:

weight: $F_g = mg$
friction: $f = \mu\, N$

You should also know how to use tension and normal forces.

For objects constrained to move in a circle the acceleration is given by:

$$a = v^2/r$$

Section 6-3 will not appear on the exam.

Most, but not all, exam questions will be based on assigned homework problems, examples done in class, and quiz questions. Review these!