ES 442 - Review for Exam Three (Spring 2003)

You are required to bring a calculator to the exam and formulas will be supplied for the exam.

Chapter Twelve - Linear Kinetics
1. Newton's laws of motion:
   - Law of Inertia
   - Law of Acceleration: \( F = ma \)
   - Law of Reaction
   - Freebody diagram

   Properties of Force: Magnitude, Direction, Angle relative to horizontal, Point of application

   Applications: characteristics of GRF in gait, elevator, muscle force, force platform

2. Mechanical Behaviors of bodies in contact
   - Friction: static, kinetic, rolling coefficients of friction, applications
   - Momentum: \( M = mv \), Conservation of momentum
   - Impulse: \( \text{Impulse} = \text{Fd} \), applications (gait GRF & others)
   - Impulse and momentum relationship
   - Impact: elastic and plastic, coefficient of restitution

3. Work, Power and Energy Related Issues
   - Work
   - Power: work and power relationship, different ways to compute power
   - Energy: kinetic, potential and elastic energy,
   - Conservation of energy: applications in pole vault and trampoline
   - Work and energy relationship: Applications: computation of vertical jump using conservation of energy and kinematic (projectile) principles

4. Concepts
   - coefficient of friction, angle of force application, conservation of momentum, density, force platform, free body diagram, friction, inertia, kinetic energy, kinetics, kinetic friction, Law of Conservation of Energy, linear kinetics, mass, momentum, point of force application, potential energy, static friction, strain energy, weight, work, power, rolling friction

Chapter Thirteen - Equilibrium
1. Equilibrium
   - Torque: \( T = Fd \), couple, moment arm
   - Resultant muscle torque
   - Lever system: 3 classes, anatomical levers, mechanical advantage, and differential effects of muscle force components on joint motions
   - Static equations of equilibrium: \( F_x = 0 \), \( F_y = 0 \), \( T = 0 \), computations in anatomical lever (with angle of muscle pull = 90°, > 90°, and < 90°), knee loading

2. Center of Gravity (COG):
   - Concepts:
   - Methods for locating the center of gravity: balance - locating body's COG with reaction board method.

3. Stability
   - Concepts
   - Factors influencing stability

4. Concepts
   - static equilibrium, dynamic equilibrium, center of gravity, center of mass, fulcrum, lever, 1st class lever, 2nd class lever, 3rd class lever, mechanical advantage, moment of force (torque), moment arm, reaction board method

You also need to know these from Chapter Ten:

Chapter Ten - Linear Kinematics
Projectile Motion

Some Concepts: Projectile Motion, Trajectory, Gravity and Air-resistance

Calculations: Horizontal and vertical components, Equations of constant acceleration, Relative height = 0

\[
V_y = V_{yi} + at \\
d = V_{yi}t + \frac{1}{2}at^2 \\
V_y^2 = V_{yi}^2 + 2ad
\]