MCHE 513: Intermediate Dynamics
Mid-Term Exam – Tuesday, October 9th

Covers Chapters 1 – 6.1, including (but not limited to):

Chapter 1 – Basic Considerations
- Newton's Laws
- Basic vector calculus (derivatives of vectors, etc)
- Energy and Momentum
  - Kinetic energy of particles
  - Work-energy principle
  - Momentum of particles
  - Impulse-momentum principle
  - Angular momentum

Chapter 2 – Particle Kinematics
- Path variables and intrinsic coordinates
  - Curves in space
  - Kinematic relationships
- Cartesian coordinates
- Curvilinear coordinate systems
  - Cylindrical coordinates
  - Spherical coordinates
- Mixed kinematical relationships

Chapter 3 – Relative Motion
- Rotational transformations
- Finite rotations
  - Body-fixed
  - Space-fixed
  - About arbitrary axes
- Angular velocity
- Angular acceleration
- Derivatives of arbitrary vectors
- Velocity and acceleration using moving reference frames
- Observations from moving frames

Chapter 4 – Kinematics of Constrained Rigid Bodies
- Describing velocities and accelerations of points on the same body
- Eulerian Angles
- Interconnections
  - Ball-and-socket
  - Pins
  - Collars
- Rolling

Chapter 5 – Inertial Effects for a Rigid Body
- Linear and angular momentum
- Inertia properties (no need to solve integrals)
  - Moments and products of inertia
  - Transformation of inertia properties
  - Principal axes
- Rate of change of angular momentum

Chapter 6 – Newtonian Kinetics of a Rigid Body
- Fundamental equations
  - Forces and point motion
  - Moments and rotation