

2 May 2017 11:30-2pm

150 minutes 8 Pages

Open books, Open notes, Calculator

100 total points

**Read, think, plan, and then write.**

Bring: books, calculator, writing instrument, ruler, snack...

**[2 pts each unless otherwise noted]**

- Discuss what the parts of an aircraft do. (e.g. ailerons, rudder, spoilers)
- Aircraft coordinate systems and nomenclature
- Airspeed and atmosphere
  
- Aircraft performance in steady level flight
- Min power
- Min thrust
- Min, Max velocity
- Maximum range
- Aircraft performance in accelerated flight
- V-n diagrams and load factor
- Takeoff/Landing
- Balanced field length
- Minimum radius and minimum time turns
  
- Stability derivatives, stability coefficients: definitions, calculation, units
- Horizontal stabilizer, elevator and longitudinal static stability analysis
- Stick forces and hinge moments
- Lateral static stability analysis including roll rates and yaw-roll coupling
  - Intuitive understanding of where dihedral effect comes from
  - Sizing control surfaces
  
- Discuss and analyze flight dynamics equations of motion.
- Create  $2 \times 2$  matrix from ODE system and calculate eigenvalues and eigenvectors
- Discuss and identify flight modes (e.g. phugoid, dutch roll, etc) from root locus and raw eigenvalues. Be prepared to know the relative frequencies and damping associated with each.
- Determine the flying qualities of aircraft with particular analytical and flight test data.
- Intuitively understand how changing aircraft surface geometry (e.g. vertical stabilizer) affects flight dynamics modes.
- Calculate inertia matrix from shape and mass.