Problem 1.

Consider a spacecraft in a circular LEO at altitude of 200km. Design a system diagram and estimate the mass and volume of a propulsion system to transfer to a circular orbit of altitude 350km. Consider your valving to protect for jet fail on/jet fail cases, as appropriate. Include propellant and N2 pressurant tanks, plumbing, valves, and a single engine for:

(a) Monopropellant (hydrazine)

(b) Bi-propellant (your choice)

Problem 2.

Read "Mission Analysis for a Micro RF Ion Thruster for CubeSat Orbital Maneuvers"

(a) Which propulsion system included in the paper would you choose for a maximum orbit change given mass and volume constraints?

(b) What is the chemical name and estimated ISP for the propellant of the system chosen in a)?

(c) If you wanted to minimize propellant usage for the circularization burn of a Hohmann transfer, where on the orbit would you burn?

(d) For use on a 3U CubeSat, what is the total mass and volume of the thruster, propellant, and tank chosen in a)?

(e) What is the nominal thrust level and input power required? Why is input power required at all?

(f) Why is the propellant you have chosen any better than hydrazine?

(g) What is the main reason that you cannot instead use the Aerojet/Rocketdyne MPS-110 Cold-Gas Thruster system for CubeSats?

Problem 3.

Read "Using Additive Manufacturing to Print a CubeSat Propulsion System"

(a) One problem encountered was arcing between a ground wire and the thruster sheath, and of course you worry about thermal containment with a spark-powered thruster in a plastic spacecraft. What would be your recommendation of a less challenging thruster system to study for incorporation into a 3-D printed CubeSat bus? Pros and cons?