

S-92.3114 Spaceflight Instrumentation

Examination on 11. Dec. 2013, at 12.15-14.00

1. Please explain (1 point each)
 - a) Give definition to common acronyms in space business: RTG, CDR, FM.
 - b) Can Hohmann transfer orbit be used with solar sail propulsion? Explain.
 - c) Which has typically higher specific impulse, chemical propulsion or electrical propulsion?
 - d) How changes the satellite contact time during overpass in respect to ground station when you slow down the satellite with a braking maneuver?
 - e) Is it possible to increase the speed of Int. Space Station with electrostatic solar sail? Explain?
 - f) What is Lagrange point?

2. Please answer (2 point each)
 - a) What are the Van Allen radiation belts? How they affect spacecraft design?
 - b) Draw a block diagram of a satellite attitude control system for a high accuracy optical camera in Moon orbit. Describe how it works.
 - c) Compare qualification and engineering model of an instrument for a Mars mission. What are the main differences?

3. (6 points) A satellite is at sun synchronous 6 o'clock orbit at altitude 800 km for a three year mission. The satellite is three axis stabilized so that the solar panel points to the sun always when possible. The solar panel area is 8 m^2 . Calculate the maximal BOL and EOL power which the satellite can use when we know that solar panel efficiency is approximately 24 % and battery charging efficiency is 80%. The solar panel efficiency will degrade 10 % per year year and the battery will loose 8 % of its capacity per year.

4. (6 points) A satellite with mass $m=50 \text{ kg}$ is inserted to circular orbit at 360 km altitude from the Space Shuttle. Inclination of the orbit is 20° . Calculate the needed ΔV in order to transfer the satellite to circular polar orbit 90° at 700 km