

EAS 4510

Exam 3

Spring 2016

20 April 2016

What Allowed During Examination/HW

You may use any books, your personal notes, or electronic aid, provided that you find the material on your own without having it provided to you by anyone else (either implicitly or explicitly). **You may not, under any circumstances, communicate with anyone about this exam/hw, and that includes me and TAs!**

Any violations of the exam/hw rules will result in further action on my part in a manner consistent with the academic honesty policy of the University of Florida. The academic honesty policy can be found at the Student Conduct and Conflict Resolution website:

<https://www.dso.ufl.edu/sccr/process/student-conduct-honor-code/>

Guidelines for Solutions

Communication is an extremely important part of demonstrating that you understand the material. To this end, the following guidelines are in effect for all problems on the examination/hw:

1. Your handwriting must be neat. I will not try to decipher sloppy handwriting and will assume that something is incorrect if I am unable to read your handwriting.
2. **ONLY FOR IN-CLASS TESTS:** your test must be HANDWRITTEN, no software, no scans, etc., your own handwriting ONLY. If anything else appears other than your own handwriting, the test will be evaluated at 0 (zero).
3. You must be crystal clear with every step of your solution. In other words, any step in a derivation or statement you write must be unambiguous (i.e., have one and only one meaning). If it is ambiguous as to what you mean in a step, then I will assume the step is incorrect.
4. Tests without name on each page, and/or without UFID and signature at the bottom of this page, will not be graded, i.e., they will count as a 0 (zero).

In short, please write your solutions in an orderly fashion so that somebody else can make sense of what you are doing and saying. Finally, credit will be given only if a relevant concept is applied properly, and no credit will be given for an incorrectly applied concept even if the final answer is correct.

University of Florida Honor Code (only for HW)

On your exam/hw you must state and sign the University of Florida honor pledge as follows:

On my honor, I have neither given nor received unauthorized aid in doing this examination/hw.

Signature:

Date:

University of Florida ID:

Total points: 100 (unless indicated otherwise, the question is right or wrong)

Questions:

1. In an inclination change maneuver about a common apse line, what is the most efficient strategy: speed change then plane change, plane change then speed change, or both at the same time? JUSTIFY [10 pts]
2. Two spacecraft, A and B travel on the same circular orbit. A leads B by X degrees in true anomaly in the direction of motion.
 - a. What should B do to increase that gap (i.e., A still leads B with a separation in true anomaly now > X deg)? [10 pts]
 - b. What would A need to do, to create the same final desired outcome? [10 pts]

IN BOTH CASES PROVIDE A QUICK QUALITATIVE JUSTIFICATION.

3. Write the Gauss Variational Equations for a , e , i , ω , Ω , and θ , when the only force model (per unit mass) is $\ddot{\vec{r}} = -\frac{\mu}{r^3}\vec{r}$. JUSTIFY [30 points, 5 per GVE]
4. For the Clohessy-Wiltshire equations, what is the relationship that the spacecraft relative initial conditions in LVLH have to respect in order to provide a non-drifting relative orbit in LVLH? JUSTIFY [10 pts]
5. At time 0 a Chief and Deputy spacecraft are in coplanar circular orbits, at the same longitude and latitude, with the Chief's distance from the center of the Earth being 7000 km and the Deputy's being 7005 km. Compute the relative initial conditions in LVLH. DO IT BY HANDS, NO SOFTWARE, OTHER THAN A CALCULATOR – NEED TO SEE THE STEPS. [20 pts: 5 for relative position, 15 for relative velocity]
6. A spacecraft orbiting Mars needs to return to Earth. Assuming a heliocentric Hohmann transfer, how would you point the \vec{V}_∞ (velocity with respect to Mars on the escape hyperbola at the sphere of influence boundary) with respect to the heliocentric velocity of Mars? JUSTIFY [10 pts]