MAE3145: Final Exam

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_____, _____.

Last Name First Name Student ID

Prob. 1 (18)	Prob. 2 (40)	Prob. 3 (22)	Prob. 4 (20)	Total (100)

Problem 1. A vehicle is in a circular orbit about the Earth with radius $r_1 = 6R_\oplus$. A Hohmann transfer is employed to shift to a smaller, coplanar circular orbit of $r_2 = 2R_\oplus$.

(a) Determine $\Delta\bar{v}_{\text{total}}$ and the time of flight.

(b) Indicate if each manuever increase or decreases the instaneous speed.

Problem 2. Develop an algorithm to determine the **PERIOD OF THE PHASING ORBIT** for a non-coplanar rendezvous problem to deploy a satellite from an inclined circular low Earth orbit to a higher, circular equatorial orbit at the **first opportunity**. The first few steps have been outlined for you; complete the remaining algorithm.

GIVEN:

Interceptor satellite COEs: $a_{int}, i, \Omega, \theta$

Target satellite COEs: a_{tgt}, θ

FIND:

Period of phasing orbit : $\mathbb{P}_{\text{phasing}}$

1. Calculate the angular speed (mean motion) for both interceptor and target.

$$\omega_{int} = \sqrt{\frac{\mu}{a_{int}^3}} \qquad \omega_{tgt} = \sqrt{\frac{\mu}{a_{tgt}^3}}$$

2. Calculate the TOF for the Hohmann transfer (complete the equation below).

3. Calculate ...

Problem 3. A radar tracking site is located at the following location: (assume a perfectly spherical Earth)

- Latitude: 90° North
- Altitude: 0 km
- Local Sidereal Time: 180°

A satellite is in a circular polar orbit with $a = 9020.5\,\text{km}, \Omega = 90°, \theta = 45°$.
Determine the following:

(a) **Range-Vector** from the site to the satellite in the Earth Centered Inertial Reference frame.

(b) **Elevation angle** and **Range** from the site to the satellite