AE 165 – Flight Mechanics

Instructor Info	Prof. J.M. Hunter jeanine.hunter@sjsu.edu
Office Hours:	Wednesday 10:30 - 11:45am and 3:00 - 3:45pm Sometimes: Monday 10:30 - 11:45am and 3:00 - 4:45pm
Credit	3 units
Class Days / Time	MW 12:00 – 1:15 pm
Class Code:	23530
Final Exam	Thursday May 19, 9:45am to 12:00pm
Classroom	Engr. 164
Prerequisites	"C-" or better in AE138
Co-requisite	AE162
Textbook	Instructor Notes
Course Website	https://sjsu.instructure.com Under the courses tab, select this course.

Description

Trajectory dynamics of atmospheric flight (aircraft and missiles) and spaceflight (orbital mechanics). Influence of vehicle design on trajectory. Aircraft static performance, stability and control. Rocket launch and re-entry dynamics. Computer simulations.

Aerospace Engineering Prof. J.M. Hunter

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Texts: Anderson: Introduction to Flight
Hunter: Flight Mechanics Course Reader (Maple Press)

References:
Sellers: Understanding Space
Curtis: Orbital Mechanics for Engineering Students
Greenwood: Principles of Dynamics
Mitiguy: Dynamics of Mechanical, Aerospace and Biomechanical Systems
Kane: Dynamics
Roskam: Airplane Flight Dynamics and Automatic Flight Controls
Nelson: Flight Stability and Automatic Control
Lan & Roskam: Airplane Aerodynamics and Performance

Course Goals:
1. To understand aircraft power required vs. thrust required.
2. To recognize the critical points on the power required curve.
3. To understand performance differences between jet and propeller-driven aircraft.
4. To understand altitude effects on aircraft performance, e.g., rate of climb.
5. To model ground effect and understand its significance.
6. To be able to draw/use a V-n diagram for a particular aircraft.
7. To understand basic concepts of aircraft static (weathervane) stability.
8. To model the longitudinal aircraft stability and control coefficients.
9. To understand the effect of center of mass shift on aircraft stability.
10. To model orbits with two-body problem assumptions.
11. To understand and derive Kepler's Laws.
12. To know the relationship between orbit type and energy.
13. To model a Hohmann transfer maneuver.

Student Learning Objectives:
1. Calculate aircraft thrust required as a function of velocity and altitude.
2. For jet- and propeller-driven aircraft, find power available.
3. Compute maximum aircraft velocity, maximum rate-of-climb, service and absolute ceilings.
4. Calculate (L/D)max, range and endurance as a function of altitude.
5. Estimate take-off distance and landing ground roll as a function of altitude.
6. Calculate minimum turn radius and maximum turn rate.
7. Find the stick-fixed neutral point of an aircraft, CL and δe for trim.
8. Determine the pitching moment coefficient and neutral point of a canard configuration.
9. Determine the forward-most limit of cg travel so that an aircraft can be trimmed at any elevator deflection.
10. Given aircraft planform configuration, find the roll control power, CLδa.
11. Size the rudder of a twin engine aircraft so that it is controllable for engine-out condition.
12. Calculate planetary escape velocity.
13. Find elliptical orbit parameters.

14. Calculate deceleration and heating for atmospheric entry.
15. Design a Hohmann transfer and calculate the total Δv.
16. Calculate the velocity for a geostationary orbit.

Spring 2016 Semester Schedule

Week	Lecture Outline
1	Equilibrium aircraft performance
2	Power/thrust requirements
3	Range & endurance requirements
4	Landing, takeoff and turning performance
5	Aircraft longitudinal static stability
6	Horizontal tail contributions
7	Longitudinal control methods
8	Longitudinal dynamic stability derivatives
9	Orbital trajectory equations of motion
10	Central force motion
11	Conic section geometry
12	Kepler's laws of planetary motion
13	Elliptical orbits
14	Orbital maneuvers, Hohmann transfer
15	Parabolic and hyperbolic orbits
16	Project Presentations & Final Exam Review

Grading for Course:	Homework 15%
	Project & Presentation 25%
	Two Hour Exams 40%
	Final Exam 20%

Grading Scale: 100 – 97% A+; 96.9 – 93% A; 92.9 – 90% A-; 89.9 – 87% B+; 86.9 – 83% B; 82.9 – 80% B-; 79.9 – 77% C+; 76.9 – 73% C; 72.9 – 70% C-; 69.9 – 67% D+; 66.9 – 63% D; 62.9 – 60% D-; < 59.9% F. All exams must be taken to receive a passing grade.

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