UNIVERSITY of HAWAI'I®
WINDWARD
COMMUNITY COLLEGE

ASTRO 170 – Introduction to Rocketry

3 Credits (CRN 62466)
TuTh 11:55a –1:20p @ Castle HS N51

INSTRUCTOR: M. Takeshi Nakata

OFFICE: Castle HS N51 or Google Meet

OFFICE HOURS: By appointment TuTh 1:20–1:50p or Fr 11:55-12:35p

TELEPHONE: - - - **EMAIL:** mtnakata@hawaii,edu

EFFECTIVE DATE: Spring 2024

WINDWARD COMMUNITY COLLEGE MISSION STATEMENT

Windward Community College offers innovative programs in the arts and sciences and opportunities to gain knowledge and understanding of Hawai'i and its unique heritage. With a special commitment to support the access and educational needs of Native Hawaiians, we provide the Ko'olau region of O'ahu and beyond with liberal arts, career and lifelong learning in a supportive and challenging environment — inspiring students to excellence.

CATALOG DESCRIPTION

This is a general introductory course to rocket science. Principles of propulsion, aerodynamics, and safety protocols for design and ground operations are stressed.

Activities Required at Scheduled Times Other than Class Times

On a pre-designated Saturday afternoon (3 hours), a model rocket launch will be held when the students will be able to participate in a model rocket launch, including safety protocols and flight operations.

STUDENT LEARNING OUTCOMES

As a result of taking this course, students can expect to attain the following outcomes:

1. Demonstrate a solid understanding of propulsive methods, especially as pertains to space.
2. Solve applicable problems of space craft kinematics, dynamics, and energy considerations.
3. Apply the laws of planetary motion and celestial mechanics.
4. Outline the historical development of manned and unmanned space flight.
5. Identify and describe the appropriate instruments, detectors and space probes used by astronomers and space scientists to explore the solar system, especially in the area of remote sensing.
6. Discuss the future of space colonization and exploitation.

COURSE TASKS & GRADING

The final grade will be determined by the total accumulated points a student has acquired throughout the semester. The tentative break down for the percentage of points will be:

- 10% Classwork - activity participate on Google Classroom
- 15% Homework - due next class period Tu or Th at 11:59p
- 65% Exams (3 Exams) - Paper
- 10% Rocket Launch Activity

COURSE CONTENT

1. GENERAL:Objectives, Scientific Method, Units, Space, Why Rockets, Anatomy of a Rocket
2. HISTORY: Early Pioneers, Early 20th century, The Space Race, Today
3. KINEMATICS: Position, Distance, Displacement, Speed & Velocity, Acceleration, 1D motion, 2D motion/Projectiles
4. FORCES: What is a Force, Newton's Laws, Gravity
5. ORBITAL MECHANICS: Energy, Work, Power, Escape Velocity, Kepler's Laws, Orbits, Orbital Maneuvers
6. PROPULSION THEORY: Dynamics, Thrust, Drag, Specific Impulse, Tsiolkovsky's, Rocket Equation, Rocket Nozzles.
7. PROPULSION METHODS: Chemical (liquid & solid), Nuclear, Electric/Ion, Solar, Comparison
8. FLIGHT DYNAMICS: Fluid Flow, Continuity Equation, Center of Mass, Center of, Pressure, Stability, GNC (Guidance/Navigation/Control)
9. OPERATIONS: Spacecraft types, Launches, Tracking & Guidance, Recovery Methods, Hazards & Disasters, Mitigation Procedures, Model Rocket Launch Day
10. REMOTE SENSING: Earth-Orbiters, Extraterrestrial Orbiters, Extraterrestrial Landers, Extraterrestrial Rovers, Beyond our solar system
11. THE FUTURE: Commercialization of Space, Colonization, Interstellar Travel, Your involvement

LEARNING RESOURCES

- Laulima: Astro 198 slidepacks by Mevan Ranasinghe. (Previous lecturer slides)
- Text: *It's ONLY Rocket Science*, Lucy Rogers, Springer Publishing, 2008.

- In addition to the above-mentioned text, students will need a scientific calculator (TI-30 or better).

DISABILITIES ACCOMMODATIONS

If you have a physical, sensory, health, cognitive, or mental health disability that could limit your ability to fully participate in this class, you are encouraged to contact the Accessibility Counselor to discuss reasonable accommodations that will help you succeed in this class. Roy Inouye can be reached at (808) 235-7448, royinouy@hawaii.edu, or you may stop by Hale Kākoʻo 106 for more information.

SEX DISCRIMINATION AND GENDER-BASED VIOLENCE RESOURCES (TITLE IX)

Windward Community College is committed to providing a learning, working, and living environment that promotes personal integrity, civility, and mutual respect and is free of all forms of sex discrimination and gender-based violence, including sexual assault, sexual harassment, gender-based harassment, domestic violence, dating violence, and stalking.

If you or someone you know is experiencing any of these, WCC has staff and resources to support and assist you. To report an incident of sex discrimination or gender-based violence, as well as receive information and support, please contact one of the following:

Leslie Cabingabang, Confidential Advocate
Phone/Text: ((808) 348-0432 or (808) 341-4952
Email: advocate@hawaii.edu
Office: Hale Kākoʻo 107

Desrae Kahale, Mental Health Counselor & Confidential Resource
Phone: (808) 235-7393
Email: dkahale3@hawaii.edu
Office: Hale Kākoʻo 101

Karen Cho, Deputy Title IX Coordinator
Phone: (808) 235-7404
Email: kcho@hawaii.edu
Office: Hale ʻAlakaʻi 120

As a member of the University faculty, I am required to immediately report any incident of sex discrimination or gender-based violence to the campus Title IX Coordinator. Although the Title IX Coordinator and I cannot guarantee confidentiality, you will still have options about how your case will be handled. My goal is to make sure you are aware of the range of options available to you and have access to the resources and support you need.

For more information regarding sex discrimination and gender-based violence, the University's Title IX resources and the University's Policy, Interim EP 1.204, go to manoa.hawaii.edu/titleix/

ACADEMIC INTEGRITY (This section is optional)

Work submitted by a student must be the student's own work. The work of others should be explicitly marked, such as through use of quotes or summarizing with reference to the original author.

In this class, students who commit academic dishonesty, cheating or plagiarism will have the following consequence(s):

Students will receive a failing grade for plagiarized assignments.

All cases of academic dishonesty are referred to the Vice Chancellor for Student Affairs.

ALTERNATE CONTACT INFORMATION

If you are unable to contact the instructor, have questions that your instructor cannot answer, or for any other issues, please contact the Academic Affairs Office:

- Location: Alakaʻi 121
- Phone: (808) 235-7422

SPRING 24 TENTATIVE CALENDAR

Week	Date	Topic	HW
1	1/09 Tue	Intro; Scientific Method	
	1/11 Thu	1- Rocket History	hw1
2	1/16 Tue	2-Motion; Graphs	
	1/16 Tue	**** Last day for 100% Refund***	
	1/18 Thu	2-Kinematic Equations 1	hw2-1
3	1/23 Tue	2-Kinematic Equations 1	
	1/25 Thu	Projectile Motion; Vectors	hw2-2
4	1/30 Tue	3-Newton's 1st and 2nd	
	2/01 Thu	3-Newton's 3rd; Circular Motion	
5	2/06 Tue	3-Universal Gravitation; Kepler's Law	
	2/08 Thu	Work Day - Forces & Circular Motion	
6	2/13 Tue	4-Energy; Orbital	hw3
	2/15 Thu		
7	2/20 Tue	**NO CLASS - CHS**	
	2/22 Thu	Review 1	hw4
8	2/27 Tue	**NO CLASS - CHS**	
	2/29 Thu	**Exam 1**	
	3/01 Fri	Work Day	

9	3/05 Tue	6-propulsion basics	
	3/07 Thu		hw6
10	3/12 Tue	7-propulsion methods	
	3/14 Thu		hw7
	3/19 Tue	**NO CLASS - Spring Break**	
	3/21 Thu	**NO CLASS - Spring Break**	
11	3/26 Tue	**NO CLASS - CHS**	
	3/28 Thu	Review 2	
12	4/02 Tue	**Exam 2**	
	4/04 Thu	8-flight dynamics	
13	4/09 Tue		
	4/11 Thu		hw8
14	4/16 Tue	9-operations	
	4/18 Thu		hw9
15	4/23 Tue	10-instruments	
	4/25 Thu		hw10
16	4/30 Tue	11-future	
	5/02 Thu		
FINAL	5/07 Tue	Review 3	