# Aerospace Engineering Course No. 21013 Credit: 1.0

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| --- | --- | --- | --- |
| **Student name:**  |  | **Graduation Date:** |  |

Pathways and CIP Codes:Engineering & Applied Mathematics (14.0101)

Course Description: An **application level** course introducing students to the world of aeronautics, flight, and engineering. Topics covered in the course may include the history of flight, aerodynamics and aerodynamics testing, flight systems, astronautics, space life systems, aerospace materials, and systems engineering.

Directions:The following competencies are required for full approval of this course. Check the appropriate number to indicate the level of competency reached for learner evaluation.

**RATING SCALE:**

4. Exemplary Achievement: Student possesses outstanding knowledge, skills or professional attitude.

3. Proficient Achievement:Student demonstrates good knowledge, skills or professional attitude. Requires limited supervision.

2. Limited Achievement:Student demonstrates fragmented knowledge, skills or professional attitude. Requires close supervision.

1. Inadequate Achievement:Student lacks knowledge, skills or professional attitude.

0. No Instruction/Training:Student has not received instruction or training in this area.

## Benchmark 1: History of Flight

### Competencies

| **#** | **DESCRIPTION** | **RATING** |
| --- | --- | --- |
| 1.1 | Students will construct a PowerPoint that shows knowledge of the history of flight. |  |
| 1.2 | Students will demonstrate an understanding of aerospace history in a Presentation Format or PowerPoint that provides insight to future challenges involving travel through the atmosphere and space. |  |
| 1.3 | Students shall identify the major components of airplanes which has a specific function in the design and operation of the airplane. |  |
| 1.4 | Students will list the various forces that act on an aircraft which enable it to fly. |  |

## Benchmark 2: Aerodynamics

### Competencies

| **#** | **DESCRIPTION** | **RATING** |
| --- | --- | --- |
| 2.1 | Students will identify the forces applied to an airplane in-flight: lift, weight, drag and thrust. |  |
| 2.2 | Students will explain aircraft theory related to wing design and its impact on the lifting forces needed to overcome the weight of an airplane. |  |
| 2.3 | Student will demonstrate their understanding of power to weight ratio. |  |
| 2.4 | Students will demonstrate basic knowledge of aerodynamics and physics. |  |

## Benchmark 3: Airfoil construction

### Competencies

| **#** | **DESCRIPTION** | **RATING** |
| --- | --- | --- |
| 3.1 | Students will design, create, and test prototypes/models of airfoils. |  |
| 3.2 | Students will create sub-scale models used to represent a full-size system. |  |
| 3.3 | Students will apply coordinate geometry to create varied shapes used to design an airfoil. |  |

## Benchmark 4: wind tunnel testing

### Competencies

| **#** | **DESCRIPTION** | **RATING** |
| --- | --- | --- |
| 4.1 | Students will use scale models to evaluate, to test, and to determine the performance of aircraft designs. |  |
| 4.2 | Students will use the wind tunnel to graph, display, evaluate and analyze test data |  |

## Benchmark 5: Glider Design & Construction

### Competencies

| **#** | **DESCRIPTION** | **RATING** |
| --- | --- | --- |
| 5.1 | The students will use flight theory to design a glider. |  |
| 5.2 | Students predict the flight performance of an aircraft utilizing flight theory. |  |
| 5.3 | Students will construct a multi-component device by the use of assembly and alignment jigs. |  |
| 5.4 | The student will collect and use flight testing data to evaluate an aircraft design |  |

## Benchmark 6: Measuring Rocket Engine Thrust

### Competencies

| **#** | **DESCRIPTION** | **RATING** |
| --- | --- | --- |
| 6.1 | Rocket thrust is measured using a simple device. |  |
| 6.2 | Students calibrate thrust measurements |  |
| 6.3 | Thrust vs. time data is acquired using a data taking device. |  |

## Benchmark 7: Model Rocket Trajectory

### Competencies

| **#** | **Description** | **RATING** |
| --- | --- | --- |
| 7.1 | Students will identify Parts of a model rocket |  |
| 7.2 | Students will understand and explain how the forces of weight, thrust, drag, and lift interact differently on a rocket in flight. |  |
| 7.3 | Students will state how Newton's three laws of motions (inertia, F- ma, and actionreaction) can be used to describe and predict events during each phase of a rocket launch. |  |
| 7.4 | The student will calculate a rocket's maximum altitude by using indirect measurement. |  |

## Benchmark 8: Orbital mechanics

### Competencies

| **#** | **Description** | **RATING** |
| --- | --- | --- |
| 8.1 | Students will create drawings to show that ellipses are conic sections, and circles are special cases of ellipses. |  |
| 8.2 | Students will create diagrams to show that orbits involve the steady procession of a small mass object around a large mass object |  |
| 8.3 | Students will calculate to show that an object in orbit is continuously "falling" toward the body about around which they orbit. |  |
| 8.4 | Students will show how orbital elements can be used to fully define a satellite's orbit, allowing the accurate prediction of the precise location of the satellite at a given time. |  |

## Benchmark 9: Life Support & Environmental Systems

### Competencies

| **#** | **Description** | **Rating** |
| --- | --- | --- |
| 9.1 | Students will describe basic physiological needs of the human body when living safely within and outside of Earth's atmosphere. |  |
| 9.2 | Students will construct a model to show how the environment on earth and in space must be considered when designing solutions to problem in aerospace engineering. |  |

## Benchmark 10: Effect of Gravity on the Human body

### Competencies

| **#** | **Description** | **rating** |
| --- | --- | --- |
| 10.1 | Students will simulate the action of spinning and how it can fool the senses and stimulate the vestibular system in the inner ear. |  |
| 10.2 | Students will work in cooperative and supportive teams to simulate how these behaviors result in increased safety and higher quality data |  |
| 10.3 | Students will investigate and give examples of how a stress-filled environment is physically unique and can affect the ability to perform mental functions. |  |

## Benchmark 11: Microgravity drop tower

### Competencies

| **#** | **Description** | **Rating** |
| --- | --- | --- |
| 11.1 | Students will describe gravity and its effects on other masses. |  |
| 11.2 | Students will state the value of "g" on earth. |  |
| 11.3 | Students will demonstrate microgravity. |  |

## Benchmark 12: Composites fabrication & testing

### Competencies

| **#** | **Description** | **Rating** |
| --- | --- | --- |
| 12.1 | Students will describe the composition of composite materials that are fabricated by molding together layers of reinforced fabric (often glass or carbon fiber) with a plastic matrix, such as epoxy. |  |
| 12.2 | Students will describe how composite materials are used in the aerospace industry |  |
| 12.3 | The student will assess material performances by comparing strength to weight ratios. |  |
| 12.4 | Students will use a deflection test to evaluate the stiffness of various composite samples. |  |

## Benchmark 13: Thermal Protection systems for Vehicles

### Competencies

| **#** | **Description** | **Rating** |
| --- | --- | --- |
| 13.1 | Students will gain an understanding of the physics of space vehicle re-entry into the atmosphere through thermal protection systems (TPS) |  |
| 13.2 | Students will describe the heat transfer process that creates high temperatures in a space vehicle. |  |

## Benchmark 14: Intelligent vehicles

### Competencies

| **#** | **Description** | **Rating** |
| --- | --- | --- |
| 14.1 | Students will evaluate incentives for building robots. |  |
| 14.2 | Students will describe uses for robotic devices. |  |
| 14.3 | Students will list robotic devices that are composed of mechanical, electrical, and computer based systems that can be programmed to make decisions and control actions based upon sensor readings. |  |

I certify that the student has received training in the areas indicated.

Instructor Signature:

For more information, contact:

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