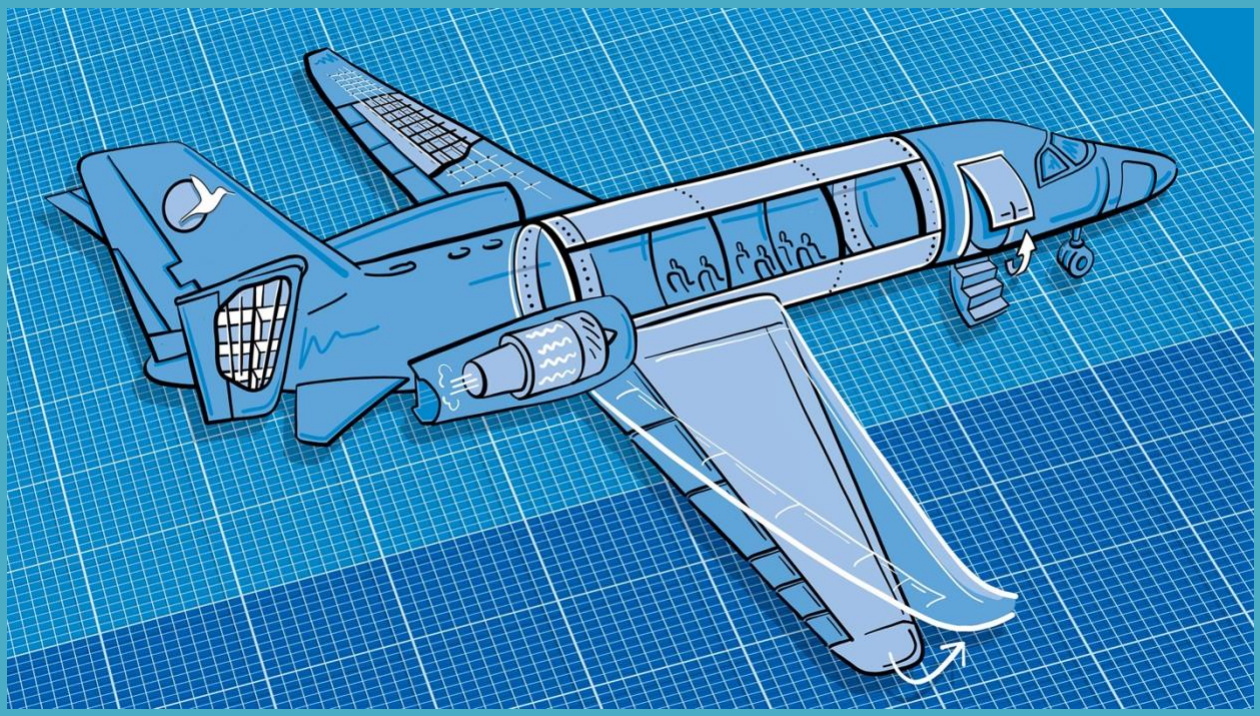
AEASM101X

Introduction to Aerospace Structures and Materials

MOOC



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AEASM101X in a Nutshell

Badge 1. Materials and the Environment

Starts: 28 August 2018
LO: Stress and Strain, Material Properties, Effect of Temperature and Environment
Activities: Your Favourite Aircraft/Spacecraft, Video, Lectures, Experiments, Quizzes, Readings
Deliverables: Exam 1, Assignment 1

Week 1

Week 2

Badge 2: Materials and Manufacturing Methods

Starts: 4 September 2018
LO: Describe the Materials and Manufacturing Methods Used in Aerospace Engineering
Activities: Video, Lectures, Experiments, Quizzes, Readings
Deliverables: Exam 2, Assignment 2

Badge 3. Aerospace Structures

Starts:11 September 2018
LO: Definition and Function of Aircraft and Spacecraft Structures
Activities: Naming Aircraft Parts, Video, Lectures, Experiments, Quizzes, Readings
Deliverables: Exam 3, Assignment 3

Week 3

Week 4

Badge 4: Loads and Stresses

Starts: 18 September 2018
LO: Aircraft Loading and Load Paths
Activities: Video, Lectures, Experiments, Quizzes, Readings
Deliverables: Exam 4, Assignment 4

Badge 5. Selection of Materials and Structures

Starts: 25 September 2018
LO: Structural Performance, Design Criteria for Aircraft and Spacecraft
Activities: Video, Lectures, Experiments, Quizzes, Readings
Deliverables: Exam 5, Assignment 5

Week 5

Week 6

Badge 6: Design Certification, Fatigue and Durability

Starts: 2 October 2018
LO: Safety & Design Philosophies, Fatigue & Damage Tolerance
Activities: Video, Lectures, Experiments, Quizzes, Readings
Deliverables: Exam 6, Assignment 6

Badge 7. Joining & Assembly

Starts: 9 October 2018
LO: Types of Joining Methods and Assembly Selection.
Activities: Video, Lectures, Experiments, Quizzes, Readings
Deliverables: Exam 7, Assignment 7

Week 7

To pass you must earn 6 out of 7 badges. Each badge can be earned by scoring more than 60% on the exam and hand in the assignment.

Deadline for all assignments, exams, and badges is **20 October 2018 (except for first part of assignment week 2. Deadline for that is 19 October 2018.)**

1. Introduction

1.1. Course overview

How do you design an aircraft or spacecraft? And in doing so, how do you keep the risk of failure minimal while bearing in mind that they will eventually fail?

In this course, you will be taken on a journey through the structural and material design of aircraft. You will see how aircraft and spacecraft are manufactured and learn how safety is enshrined at every stage.

As lecturers from the Aerospace Structures and Materials Department of Delft University of Technology, we will help you analyze the mechanical properties of materials, learn about manufacturing techniques, understand the concepts of fatigue, loads, and stresses, look at design considerations, and much more –as well as the scientific and engineering principles that structural and materials engineers face every day. By the end of the course, you will have learned to think like we do!

To do well in this course, you do not need to be an aerospace aficionado, but it certainly helps. You also do not need an extensive background in math or physics, but if you can remember some of your high school math and physics, it will most certainly come in handy.

The course will consist of seven modules, each scheduled to last about one week. In each week, you will be offered a mix of online lectures, readings from our own e-book, some experiments which you can do at home, small quizzes, and discussion forum activities. Each week, you can earn a badge by scoring at least 60% on the exam and completing the assignment. To pass the course you must earn 6 of the 7 badges.

Of course, we will follow your progress and where possible engage with you on the discussion forums.

1.2. Learning objectives/outcomes

So, what will you actually learn in this course? At the end of this course, you will be able to:

- Explain how aerospace structures are designed, and why particular choices are made
- Which materials are used, and why
- Explain the loads and stresses aerospace structures must withstand
- Explain how aircraft and spacecraft are manufactured
- Understand the safety philosophies used in aerospace structural design, and how they affect design choices
- Create preliminary design solutions for structural design problems and material choices

1.3. What we expect from you

As an online student, we expect you to be an active participant in this course by contributing to a positive atmosphere. We want you to question, share, and help others by engaging in meaningful discussions.

Regarding deadlines, we expect you to keep on track in order to benefit from learning within a community. This course is meant to be a place where you learn with and from others. In this sense, we would like you to experience collaboration and peer feedback, so please make sure you follow along with other participants to enrich the overall learning experience.

You are expected to follow forum and collaboration guidelines. Respect the course policies, academic integrity, and most importantly your fellow students.

1.4. What you can expect from us/the course team

The e-Moderators will guide you throughout the course, launching the weekly content, promoting and engaging in discussions, and providing feedback regarding your performance after each week. Guidance and support will be given on a regular basis, mainly every day.

Response Time: We will try to respond to all your questions and posts within 24-48 hours. If this is not possible for any reason, we will let you know.

2. Course structure

The course is organized in seven topics, each lasting one week. A brief summary of each week is presented below. Detailed instructions and resources will be provided during the course.

Week 1: Course Introduction and Materials and the Environment

Starts 28 August 2018

In the Getting Started section, you'll get to know the course structure, become familiar with the virtual learning environment, complete your profile, meet your fellow students and the e-moderator. These introductory tasks should be completed in the beginning of the course, after your first login.

After that we will really get started. First, we will take you through the basic concepts of material properties and the phenomena of stress and strain. We will also throw in a few experiments, which you can also do at home, so you can get a real hands-on feel for the concepts. After that, we will take you through what happens to an aircraft or spacecraft at different temperatures and environments. In your first assignment, we will ask you to take a closer look at your favourite aircraft or spacecraft and research it from a structures and materials point-of-view.

Week 2. Materials and Manufacturing Methods

Starts 4 September 2018

Here, we will introduce the typical aerospace materials such as metals, ceramics, and composites. Every material has its own unique properties, critical to the design of aerospace structures, which we will introduce to you. You will also learn all about various manufacturing methods for these materials. We will also let you play around and create your own composite materials! In your second assignment, you will be challenged to start thinking like a true aerospace structures and materials engineer and come up with your first design proposal.

Week 3. Aerospace Structures

Starts 11 September 2018

In this week, we will really dive into the lingo of aircraft and spacecraft. Terms such as stiffeners, frames, and bulkheads, will no longer hold any secrets for you. We will also do some more experiments to demonstrate why certain structural elements are essential to keep your aircraft or spacecraft flying. This week's assignment involves studying the skeleton of your favorite aircraft or spacecraft and identify why certain structural elements were used by their designers.

Week 4. Loads and Stresses

Starts 18 September 2018

We continue our focus on structures by studying loads that act on the different aircraft parts, the paths these loads travel through a structure on, and how this affects design choices when designing wings and fuselages. We will explain the consequences of having a pressurized fuselage for aircraft design as well as look in detail of the bending of wing spars and what that means for wing design. At the end of this week, you will face your first dilemma as a designer: how to satisfy all design requirements even if they appear contradictory?

Week 5. Selection of Materials and Structures

Starts 25 September 2018

This week, we will take a closer look at the structural performance of aircraft. Building on your knowledge bank thus far, you will learn how to select the appropriate structural and materials solution for a design problem based on stiffness and strength. The concepts of specific strength and specific modulus will be introduced to aid you in selecting the right material. We will also take you through the basic steps on how to dimension a spacecraft. Your assignment this week will definitely involve some number cracking!

Week 6. Design Certification, Fatigue, and Durability

Starts 2 October 2018

If you are a fan of those aircraft investigation shows on the television, you will most likely enjoy this week. However, we will also show you that life isn't quite like television, should you still be in any doubt. You will learn how, during the design process, many possibilities for failure are already eliminated, and the underlying philosophies for why. We will also discuss fatigue and damage tolerance, as they are critical if we want to monitor and improve the durability of aircraft and spacecraft. In your assignment for this week, we will take you back to an aircraft accident and ask you to look at it again with your newly gained knowledge.

Week 7. Joining and Assembly

Starts 9 October 2018

We hope you feel the time has flown by! Though this will be our last week, we still have one more exciting topic to explore. You've learned about different structures in aerospace engineering and how to select the right material for the job, but aircraft and spacecraft aren't held together by magic! This week, we will look at how aircraft and spacecraft are assembled, and what joining methods are used and why. As your final assignment, you will choose a joining method for your aircraft based on a dilemma we will pose to you!

Week 8. Wrap up

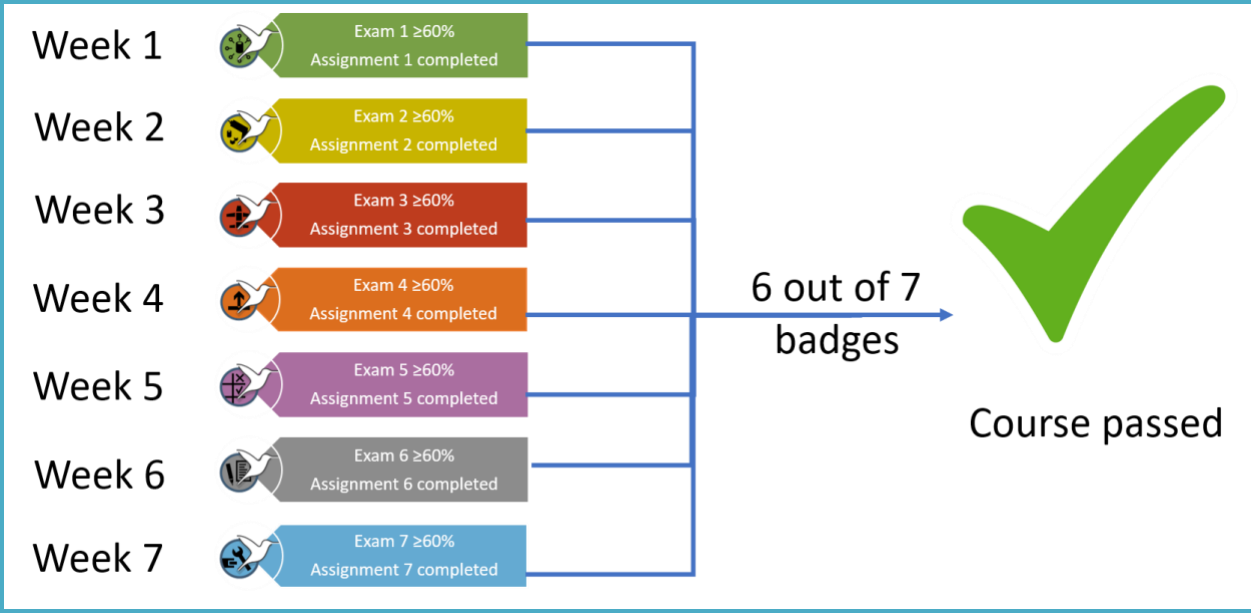
Starts 16 October 2018

As always, no job is done until the paperwork is done. This week, we ask you to look back at your initial expectations and see how far you have come. If you decided to go for the Verified Certificate Option, those will be handed out and we kindly ask you to give us some feedback on what you liked in the course and which bits could be improved.

After that we will say goodbye, although we do hope to see you again in some of our other course offerings in aerospace structures and materials as listed on www.online-learning.tudelft.nl.

3. Assessment

As previously mentioned, you can earn a badge each week. To successfully complete the course, you will need to earn 6 out of 7 badges. Each week has an assignment and exam. To earn a badge, you must score more than 60% on the weekly exam and complete the assignment. Criteria for the assignments are detailed in the course. The deadline for all exams and assignments is **20 October 2018 at 12:00 UTC**, with the exception for week 2. In order for your fellow learners to be able to assess your work, you must submit your assignment for peer assessment **before 19 October 2018 at 12:00 UTC**.



4. Resources & Tools

All educational resources will be available in the course. They consist of short videos and readings to support you in the completion of the weekly learning activities.

If you want to repeat some of the experiments shown, you may need to acquire some items. We have aimed to create each experiment so that you can easily get the items you need without great expense, if any at all.

Additionally, you will be given access to the newly published Open Textbook Introduction to Aerospace Structures and Materials by Rene Alderliesten. This book will be made available for free as a PDF.

No special tools will be needed to complete this course.

5. Certificate

f you're interested in a certificate you can upgrade to a Verified Certificate. These certificates will indicate you have successfully completed the course, but will not include a specific grade. Certificates will be issued by edX under the name of DelftX, designating the institution from which the course originated.

Generating an ID verified certificate

Verified certificates will be issued a few days after the end of the course, to all participants who achieved at least 85% of the total grade. Certificates can be downloaded from your Student Dashboard (look for the Download button next to the name of our course). Remember that in

order to qualify for a certificate, you must achieve a total grade of 85% or higher. You can check your grade at any time under the course's Progress page. An ID verified Certificate of Achievement is available for $50. You can Upgrade on your edX Dashboard to Verified during the course. Once produced, a certificate cannot be reissued, hence it is very important that you verify the way in which your name appears. Check that, in your edx.org account, your name is correctly spelled, since it will appear on the final certificate.

6. License

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Online Learning Support: onlinelearningsupport@tudelft.nl
Office Hours: every day from 08:00 to 24:00 (Amsterdam time)