

Module description: Aircraft Systems - Structure and Mechanical Systems	
Module Code	t.BA.AV.ACSYS-SM-EN.19HS
ECTS Credits	4
Language of Instruction/Examination	English
Organizational Unit	ZAV
Module Coordinator	Wilm Friedrichs
Legal Framework	The module description is part of the legal basis in addition to the general academic regulations. It is binding. During the first week of the semester a written and communicated supplement can specify the module description in more detail.
Module Characteristic	Type 3c*** 2 lecture lessons per semester week each yearly starting-class + 2 lab lessons per semester week and class
Module Description	The Structure and Mechanical Systems module deals with the principles of aircraft design and mechanical systems.
Module Content	<p>Aircraft Structure</p> <ul style="list-style-type: none"> • Introduction - stress-strain relationship; strain gauges - types of structural loading (tension, compression, torsion, shear, bending) • Aircraft materials - properties of metallic materials - fasteners and joints - corrosion - lightning strike considerations • Static design principles - Static equilibrium - Static stability; buckling of columns and panels • Aircraft loads - aerodynamic and inertia loads - flight and ground loads - flight envelope - gust loads • Aircraft structural design - Basic principles of truss, beam and shell structures - Monocoque and semi-monocoque design - Design philosophies: safe life, fail safe, damage tolerance - Fatigue requirements and testing • Structural components - wing and empennage - fuselage - landing gear - engine mounts • Stresses of structural elements - wing spar loading - loading of fuselage frames, beams and stringers • Dynamic loads and aeroelasticity - introduction to dynamic loads - introduction to aeroelasticity - torsional and aileron divergence - flutter <p>Mechanical Systems</p> <ul style="list-style-type: none"> • Introduction - system design - safety, security, and redundancy • Emergency systems - introduction - warning, protection and escape systems - flight data and voice recorders • The cockpit - requirements and standards - evolution of aircraft displays - display system architecture - modern developments • The flight control system - principles - control surfaces - mechanical flight control systems - powered flight control systems; control feel - actuation - fly-by-wire systems • The hydraulic system - functions - general layout - hydraulic fluids - cooling and filtering - components • The landing gear - configurations and layouts - fixed and retractable gears - loads - shock absorbers - steering - brakes, wheels and tyres • The pneumatic system - functions - pneumatic power generation and control - uses of bleed air in an aircraft • The environmental control system - the need for a controlled cabin environment - air conditioning - cabin pressurisation • Ice protection - icing conditions - effects of ice accretion - ice detection - anti-icing and de-icing in flight - anti-icing and de-icing on the ground • The fuel/energy storage and supply system - aviation fuels - fuel storage - fuel distribution & management - alternative energy sources; SAF, battery, hydrogen - Safety considerations
Prerequisite Knowledge	

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Learning Objectives (Competences)	Students...		Competencies	Taxonomies		
	be able to understand and explain principles, functions and interactions of structural components and mechanical systems		F, M	K2		
	be able to understand aircraft technical literature (Aircraft Operating Manuals, System Manuals)		F	K2		
	be able to identify the various components and subsystems of the system "aircraft"		F	K1		
	analyse and compare different aircraft system architecture solutions		F	K4		
Performance Assessment	End-of-module exam	Assessment	Length (min.)	Weighting	Form	
	written exam	Grade	90	100	acc. to module agreement	
	Performance assessment during the semester		Assessment	Length (min.)	Weighting	Form
	Lab <i>Preparation of, active participation in, and dissemination of one lab session, including preparation and submission of a report</i>		predicate		0	acc. to module agreement
Classroom Attendance Requirement	None Participation in one lab					
Learning material						
Comments						