

**MODULE 13. AIRCRAFT AERODYNAMICS, STRUCTURES AND SYSTEMS**

Regulation (EU) 2018/1142

MODULE 13. AIRCRAFT AERODYNAMICS, STRUCTURES AND SYSTEMS	LEVEL
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13.1 <i>Theory of Flight</i>	
(a) <i>Aeroplane Aerodynamics and Flight Controls</i> Operation and effect of: — roll control: ailerons and spoilers; — pitch control: elevators, stabilators, variable incidence stabilisers and canards; and — yaw control: rudder limiters; Control using elevons, ruddervators; High lift devices: slots, slats, flaps; Drag inducing devices: spoilers, lift dumpers, speed brakes; and Operation and effect of trim tabs, servo tabs and control surface bias.	1
(b) <i>High Speed Flight</i> Speed of sound, subsonic flight, transonic flight, supersonic flight; Mach number, critical Mach number.	1
(c) <i>Rotary Wing Aerodynamics</i> Terminology; Operation and effect of cyclic, collective and anti-torque controls.	1
13.2 <i>Structures — General Concepts</i>	
Fundamentals of Structural Systems	1
Zonal and Station Identification Systems	2
Electrical bonding	2
Lightning strike protection provision.	2
13.3 <i>Autoflight (ATA 22)</i>	
(a) Fundamentals of automatic flight control including working principles and current terminology; Command signal processing; Modes of operation: roll, pitch and yaw channels; Yaw dampers; Stability Augmentation System in helicopters; Automatic trim control; Autopilot navigation aids interface;	3
(b) Autothrottle systems; Automatic landing systems: principles and categories, modes of operation, approach, glideslope, land, go-around, system monitors and failure conditions.	3
13.4 <i>Communication/Navigation (ATA 23/34)</i>	

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<p>(a)</p> <p>Fundamentals of radio wave propagation, antennas, transmission lines, communication, receiver and transmitter; Working principles of following systems:</p> <ul style="list-style-type: none"> <li>— Very High Frequency (VHF) communication;</li> <li>— High Frequency (HF) communication;</li> <li>— Audio;</li> <li>— Emergency Locator Transmitters (ELTs);</li> <li>— Cockpit Voice Recorder (CVR);</li> <li>— Very High Frequency Omnidirectional Range (VOR);</li> <li>— Automatic Direction Finding (ADF);</li> <li>— Instrument Landing System (ILS);</li> <li>— Flight Director Systems (FDSs), Distance Measuring Equipment (DME);</li> <li>— Area navigation, RNAV systems;</li> <li>— Flight Management Systems (FMSs);</li> <li>— Global Positioning System (GPS), Global Navigation Satellite Systems (GNSSs);</li> <li>— Data Link.</li> </ul>	3
<p>(b)</p> <ul style="list-style-type: none"> <li>— Air Traffic Control transponder, secondary surveillance radar;</li> <li>— Traffic Alert and Collision Avoidance System (TCAS);</li> <li>— Weather avoidance radar;</li> <li>— Radio altimeter;</li> <li>— Automatic Dependent Surveillance — Broadcast (ADS-B).</li> </ul>	3
<p>(c)</p> <ul style="list-style-type: none"> <li>— Microwave Landing System (MLS);</li> <li>— Very Low Frequency and hyperbolic navigation (VLF/Omega);</li> <li>— Doppler navigation;</li> <li>— Inertial Navigation System (INS);</li> <li>— ARINC (Aircraft Radio Incorporated) communication and reporting.</li> </ul>	3
<p>13.5 <i>Electrical Power (ATA 24)</i></p> <p>Batteries installation and operation; Direct Current (DC) power generation; Alternating Current (AC) power generation; Emergency power generation; Voltage regulation; Power distribution; Inverters, transformers, rectifiers; Circuit protection; External/Ground power.</p>	3
<p>13.6 <i>Equipment and Furnishings (ATA 25)</i></p> <p>Electronic emergency equipment requirements; Cabin entertainment equipment.</p>	3
<p>13.7 <i>Flight Controls (ATA 27)</i></p> <p>(a)</p> <p>Primary controls: aileron, elevator, rudder, spoiler; Trim control; Active load control; High lift devices; Lift dump, speed brakes; System operation: manual, hydraulic, pneumatic;</p>	2

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Artificial feel, Yaw damper, Mach trim, rudder limiter, gust locks; Stall protection systems. (b) System operation: electrical, fly-by-wire.	3
13.8 <i>Instruments (ATA 31)</i> Classification; Atmosphere; Terminology; Pressure-measuring devices and systems; Pitot-static systems; Altimeters; Vertical-speed indicators; Airspeed indicators; Machmeters; Altitude-reporting/alerting systems; Air data computers; Instrument pneumatic systems; Direct-reading pressure and temperature gauges; Temperature-indicating systems; Fuel-quantity-indicating systems; Gyroscopic principles; Artificial horizons; Slip indicators; Directional gyros; Ground Proximity Warning Systems (GPWSs); Compass systems; Flight Data Recording Systems (FDRs); Electronic Flight Instrument Systems (EFISs); Instrument warning systems including master warning systems and centralised warning panels; Stall warning systems and angle of attack-indicating systems; Vibration measurement and indication; Glass cockpit.	3
13.9 <i>Lights (ATA 33)</i> External: navigation, landing, taxiing, ice; Internal: cabin, cockpit, cargo; Emergency.	3
13.10 <i>On Board Maintenance Systems (ATA 45)</i> Central maintenance computers; Data-loading system; Electronic-library system; Printing system; Structure-monitoring (damage tolerance monitoring).	3
13.11 <i>Air Conditioning and Cabin Pressurisation (ATA 21)</i> 13.11.1. <i>Air supply</i> Sources of air supply including engine bleed, APU and ground cart;	2
13.11.2. <i>Air Conditioning</i> Air-conditioning systems;	2
Air cycle and vapour cycle machines;	3
Distribution systems;	1

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Flow, temperature and humidity control system.	3
13.11.3. <i>Pressurisation</i> Pressurisation systems; Control and indication including control and safety valves; Cabin pressure controllers.	3
13.11.4. <i>Safety and warning devices</i> Protection and warning devices.	3
13.12 <i>Fire Protection (ATA 26)</i> (a) Fire and smoke detection and warning systems; Fire-extinguishing systems; System tests;	3
(b) Portable fire extinguisher.	1
13.13 <i>Fuel Systems (ATA 28)</i> System layout;	1
Fuel tanks;	1
Supply systems;	1
Dumping, venting and draining;	1
Cross feed and transfer;	2
Indications and warnings;	3
Refuelling and defuelling;	2
Longitudinal-balance fuel systems.	3
13.14 <i>Hydraulic Power (ATA 29)</i> System layout;	1
Hydraulic fluids;	1
Hydraulic reservoirs and accumulators;	1
Pressure generation: electrical, mechanical, pneumatic;	3
Emergency pressure generation;	3
Filters;	1
Pressure control;	3
Power distribution;	1
Indication and warning systems;	3
Interface with other systems.	3
13.15 <i>Ice and Rain Protection (ATA 30)</i> Ice formation, classification and detection;	2
Anti-icing systems: electrical, hot-air and chemical;	2
De-icing systems: electrical, hot-air, pneumatic, chemical;	3
Rain-repellent;	1
Probe and drain-heating;	3
Wiper systems.	1
13.16 <i>Landing Gear (ATA 32)</i> Construction, shock absorbing;	1
Extension and retraction systems: normal and emergency;	3
Indications and warnings;	3

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Wheels, brakes, antiskid and automatic braking systems;	3
Tyres;	1
Steering;	3
Air-ground sensing.	3
13.17 <i>Oxygen (ATA 35)</i>	
System layout: cockpit, cabin;	3
Sources, storage, charging and distribution;	3
Supply regulation;	3
Indications and warnings.	3
13.18 <i>Pneumatic/Vacuum (ATA 36)</i>	
System layout;	2
Sources: engine/APU, compressors, reservoirs, ground supply;	2
Pressure control;	3
Distribution;	1
Indications and warnings;	3
Interfaces with other systems.	3
13.19 <i>Water/Waste (ATA 38)</i>	2
Water system layout, supply, distribution, servicing and draining;	
Toilet system layout, flushing and servicing.	
13.20 <i>Integrated Modular Avionics (ATA 42)</i>	3
Core system;	
Network components.	
<i>Note: Functions that may be typically integrated into the IMA modules are among others:</i>	
– bleed management;	
– air pressure control;	
– air ventilation and control;	
– avionics and cockpit ventilation control, temperature control;	
– air traffic communication;	
– avionics communication router;	
– electrical load management;	
– circuit breaker monitoring;	
– electrical system Built-In Test Equipment (BITE);	
– fuel management;	
– braking control;	
– steering control;	
– landing gear extension and retraction;	
– tyre pressure indication;	
– oleo pressure indication;	
– brake temperature monitoring.	
13.21 <i>Cabin Systems (ATA 44)</i>	3
The units and components which furnish a means of entertaining the passengers and providing communication within the aircraft (Cabin Intercommunication Data System (CIDS)) and between the aircraft cabin and ground stations (Cabin Network Service (CNS)). They include voice, data, music and video transmissions.	
CIDS provides an interface between cockpit/cabin crew and cabin systems. These systems support data exchange between the different related Line Replaceable Units (LRUs) and they are typically operated via Flight Attendant Panels (FAPs).	

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<p>CNS typically consists of a server, interfacing with, among others, the following systems:</p> <ul style="list-style-type: none"> <li>— Data/Radio Communication;</li> <li>— Cabin Core System (CCS);</li> <li>— In-flight Entertainment System (IFES);</li> <li>— External Communication System (ECS);</li> <li>— Cabin Mass Memory System (CMMS);</li> <li>— Cabin Monitoring System (CMS);</li> <li>— Miscellaneous Cabin Systems (MCSs).</li> </ul> <p>CNS may host functions such as:</p> <ul style="list-style-type: none"> <li>— access to pre-departure/departure reports;</li> <li>— e-mail/intranet/internet access;</li> <li>— passenger database.</li> </ul>	
<p><b>13.22 Information Systems (ATA 46)</b></p> <p>The units and components which furnish a means of storing, updating and retrieving digital information traditionally provided on paper, microfilm or microfiche. They include units that are dedicated to the information storage and retrieval function such as the electronic library mass storage and controller, but they do not include units or components installed for other uses and shared with other systems, such as flight deck printer or general-use display.</p> <p>Typical examples include:</p> <ul style="list-style-type: none"> <li>— Air Traffic and Information Management systems and Network Server systems.</li> <li>— Aircraft general information system;</li> <li>— Flight deck information system;</li> <li>— Maintenance information system;</li> <li>— Passenger cabin information system;</li> <li>— Miscellaneous information systems.</li> </ul>	<b>3</b>