

## Module 12

# Helicopters Aerodynamics Structures and Systems

	Level			
	A	B1	B2	B3
12.1 Theory of Flight — Rotary Wing Aerodynamics	1	2	-	-
Terminology; Effects of gyroscopic precession Torque reaction and directional control; Dissymmetry of lift, Blade tip stall; Translating tendency and its correction; Coriolis effect and compensation; Vortex ring state, power settling, overpitching; Auto-rotation; Ground effect.				
12.2 Flight Control Systems	2	3		
Cyclic control; Collective control; Swashplate; Yaw control: Anti-Torque Control, Tail rotor, bleed air; Main Rotor Head: Design and Operation features; Blade Dampers: Function and construction; Rotor Blades: Main and tail rotor blade construction and attachment; Trim control, fixed and adjustable stabilisers; System operation: manual, hydraulic, electrical and fly-by-wire; Artificial feel; Balancing and rigging.				
12.3 Blade Tracking and Vibration Analysis	1	3		
Rotor alignment; Main and tail rotor tracking; Static and dynamic balancing; Vibration types, vibration reduction methods; Ground resonance.				

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12.4 Transmission	1	3		
<p>Gear boxes, main and tail rotors; Clutches, free wheel units and rotor brake; Tail rotor drive shafts, flexible couplings, bearings, vibration dampers and bearing hangers.</p>				
12.5 Airframe Structures	2	2	-	-
<p>(a) Airworthiness requirements for structural strength; Structural classification, primary, secondary and tertiary; Fail safe, safe life, damage tolerance concepts; Zonal and station identification systems; Stress, strain, bending, compression, shear, torsion, tension, hoop stress, fatigue; Drains and ventilation provisions; System installation provisions; Lightning strike protection provision;</p>				
(b) Construction methods of: stressed skin fuselage, formers, stringers, longerons, bulkheads, frames, doublers, struts, ties, beams, floor structures, reinforcement, methods of skinning and anti-corrosive protection. Pylon, stabiliser and undercarriage attachments; Seat installation; Doors: construction, mechanisms, operation and safety devices; Windows and windscreen construction; Fuel storage; Firewalls; Engine mounts; Structure assembly techniques: riveting, bolting, bonding; Methods of surface protection, such as chromating, anodising, painting; Surface cleaning. Airframe symmetry: methods of alignment and symmetry checks	1	2	-	-

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### 12.6 Air Conditioning (ATA 21)

12.6.1 Air supply	1	2	-	-
Sources of air supply including engine bleed and ground cart.				
12.6.2 Air conditioning	1	3	-	-
Air conditioning systems; Distribution systems; Flow and temperature control systems; Protection and warning devices.				

### 12.7 Instruments/Avionic Systems

12.7.1 <i>Instrument Systems (ATA 31)</i>	1	2	-	-
Pitot static: altimeter, air speed indicator, vertical speed indicator; Gyroscopic: artificial horizon, attitude director, direction indicator, horizontal situation indicator, turn and slip indicator, turn coordinator; Compasses: direct reading, remote reading; Vibration indicating systems — HUMS; Glass cockpit; Other aircraft system indication.				
12.7.2 <i>Avionic Systems</i>	1	1	-	-
Fundamentals of system layouts and operation of: Auto Flight (ATA 22); Communications (ATA 23); Navigation Systems (ATA 34).				

### 12.8 Electrical Power (ATA 24)

12.8 Electrical Power (ATA 24)	1	3	-	-
Batteries Installation and Operation; DC power generation, AC power generation; Emergency power generation; Voltage regulation, Circuit protection. Power distribution; Inverters, transformers, rectifiers; External/Ground power.				

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### 12.9 Equipment and Furnishings (ATA 25)

(a) Emergency equipment requirements; Seats, harnesses and belts; Lifting systems;	2	2	-	-
(b) Emergency flotation systems; Cabin lay-out, cargo retention; Equipment lay-out; Cabin Furnishing Installation	1	1	-	-

### 12.10 Fire Protection (ATA 26)

Fire and smoke detection and warning systems;  
Fire extinguishing systems;  
System tests.

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### 12.11 Fuel Systems (ATA 28)

System lay-out;  
Fuel tanks;  
Supply systems;  
Dumping, venting and draining;  
Cross-feed and transfer;  
Indications and warnings;  
Refuelling and defuelling.

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### 12.12 Hydraulic Power (ATA 29)

System lay-out;  
Hydraulic fluids;  
Hydraulic reservoirs and accumulators;  
Pressure generation: electric, mechanical, pneumatic;  
Emergency pressure generation;  
Filters;  
Pressure Control;  
Power distribution;  
Indication and warning systems;  
Interface with other systems.

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<p>12.13 Ice and Rain Protection (ATA 30)</p> <p>Ice formation, classification and detection; Anti-icing and De-icing systems: electrical, hot air and chemical; Rain repellent and removal; Probe and drain heating; Wiper system.</p>	1	3	-	-
<p>12.14 Landing Gear (ATA 32)</p> <p>Construction, shock absorbing; Extension and retraction systems: normal and emergency; Indications and warning; Wheels, Tyres, brakes; Steering; Air-ground sensing Skids, floats.</p>	2	3	-	-
<p>12.15 Lights (ATA 33)</p> <p>External: navigation, landing, taxiing, ice; Internal: cabin, cockpit, cargo; Emergency.</p>	2	3	-	-
<p>12.16 Pneumatic/Vacuum (ATA 36)</p> <p>System lay-out; Sources: engine/APU, compressors, reservoirs, ground supply; Pressure control; Distribution; Indications and warnings; Interfaces with other systems</p>	1	3	-	-

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12.17 Integrated Modular Avionics (ATA42)	1	2	-	-
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Functions that may be typically integrated in the Integrated Modular Avionic (IMA) modules are, among others: 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 BITE, Fuel Management, Braking Control, Steering Control, Landing Gear Extension and Retraction, Tyre Pressure Indication, Oleo Pressure Indication, Brake Temperature Monitoring, etc.

Core System;

Network Components.

12.18 On Board Maintenance Systems (ATA45)	1	2	-	-
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Central maintenance computers;

Data loading system;

Electronic library system;

Printing;

Structure monitoring (damage tolerance monitoring).

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### 12.19 Information Systems (ATA46)

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The units and components which furnish a means of storing, updating and retrieving digital information traditionally provided on paper, microfilm or microfiche. Includes units that are dedicated to the information storage and retrieval function such as the electronic library mass storage and controller. Does not include units or components installed for other uses and shared with other systems, such as flight deck printer or general use display.

Typical examples include Air Traffic and Information Management Systems and Network Server Systems.

Aircraft General Information System;

Flight Deck Information System

Maintenance Information System;

Passenger Cabin Information System;

Miscellaneous Information System.