

1. Title	Helicopter aerodynamics, structures and systems I
2. Code	EMAMAH401A
3. Range	The knowledge is needed for a wide range of helicopter repair and maintenance works, e.g. applicable to aircrafts, analysis, machineries, airworthiness, airframes, avionics, materials, tests, documentation, safety, health and tools etc.
4. Level	4
5. Credit	2
6. Competency	<p style="text-align: center;"><u>Performance Requirement</u></p> <p>6.1 Knowledge</p> <ul style="list-style-type: none"> ◆ Able to understand the theory of of flight - Rotary wing aerodynamics <ul style="list-style-type: none"> • 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 setting, overpitching. • Auto-rotation. • Ground effect. ◆ Able to understand the flight control system <ul style="list-style-type: none"> • 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.
- ◆ Able to understand the blade tracking and vibration analysis
 - Rotor alignment.
 - Main and tail rotor tracking.
 - Static and dynamic balancing.
 - Vibration types, vibration reduction methods.
 - Ground resonance.
- ◆ Able to understand the transmissions
 - Gear boxes, main and tail rotors.
 - Clutches, free wheel units and rotor brake.
- ◆ Able to understand the airframe Structures
 - Airworthiness requirements for structural strength.
 - Construction methods of:
- ◆ Able to understand the air conditioning (ATA 21)
 - Air supply
 - Sources of air supply including engine bleed, APU and ground cart.
 - Air conditioning
 - Air conditioning systems.
 - Distribution systems.
 - Flow and temperature control system.
 - Protection and warning devices.

- ◆ Able to understand the Instruments/Avionic Systems
 - Instrument Systems (ATA 31)
 - 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.
 - Compass compensation and adjustment.
 - Vibration indicating systems - HUMS.
 - Other aircraft system indication.
 - Avionic Systems
 - Fundamentals of system lay-outs and operation of:
 - Auto Flight (ATA 22).
 - Communications (ATA 23).
 - Navigation Systems (ATA 34).
- ◆ Able to understand the electrical power (ATA 24)1
 - Batteries Installation and Operation.
 - DC power generation.
 - AC power generation.
 - Emergency power generation.
 - Voltage regulation.
 - Power distribution.
 - Inverters, transformers, rectifiers.
 - External / Ground power.
- ◆ Able to understand the equipment and furnishings (ATA 25)
 - Emergency equipment requirements.
 - Emergency flotation systems.

- ◆ Able to understand the fire protection (ATA 26)
 - Fire and smoke detection and warning systems.
 - Fire extinguishing systems.
 - System tests.
- ◆ Able to understand the 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.
- ◆ Able to understand the hydraulic power (ATA 29)
 - System lay-out.
 - Hydraulic fluids.
 - Hydraulic reservoirs and accumulators.
 - Pressure generation: electric, mechanical, pneumatic.
 - Emergency pressure generation.
 - Pressure Control.
 - Power distribution.
 - Indication and warning systems.
 - Interface with other systems.
- ◆ Able to understand the ice and rain protection (ATA 30)
 - Ice formation, classification and detection.
 - Anti-icing and De-icing systems: electrical, hot air and chemical.
 - Rain repellent and removal.
 - Probe and drain heating.

	<ul style="list-style-type: none"> ◆ Able to understand the landing gear (ATA 32) <ul style="list-style-type: none"> • Construction, shock absorbing. • Extension and retraction systems: normal and emergency. • Indications and warning. • Wheels, Tyres, brakes. • Steering. • Skids, floats. ◆ Able to understand the lights system (ATA 33) <ul style="list-style-type: none"> • External: navigation, anti-collision, landing, taxiing, ice. • Internal: cabin, cockpit, cargo. • Emergency. ◆ Able to understand the pneumatic/vacuum (ATA 36) <ul style="list-style-type: none"> • System lay-out. • Sources: engine, compressors, reservoirs, ground supply. • Pressure control. • Distribution. • Indications and warnings. • Interfaces with other systems. <p>6.2 Theoretical and practical aspects</p> <ul style="list-style-type: none"> ◆ Able to apply the following knowledge in the aircraft maintenance. <ul style="list-style-type: none"> • Flight control system • Airframe structures • Equipment and furnishings (ATA 25) • Landing gear (ATA 32) • Lights (ATA 33)
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	<p>6.3 Professional approach</p> <ul style="list-style-type: none"> ◆ Able to understand the principal elements of the subjects. ◆ Able to understand the general knowledge of the theoretical and practical aspects of the following subjects. <ul style="list-style-type: none"> • Flight control system • Airframe structures • Equipment and furnishings (ATA 25) • Landing gear (ATA 32) • Lights (ATA 33) ◆ Able to apply the knowledge in the aircraft maintenance task.
<p>7. Assessment Criteria</p>	<p>The integral outcomes requirement of this UoC are:</p> <ul style="list-style-type: none"> (i) Able to understand the theoretical fundamentals of the subjects. (ii) Able to give a general description of the subjects using, as appropriate, typical examples. (iii) Able to use mathematical formulae in conjunction with physical laws describing the subjects. (iv) Able to read and understand sketches, drawings and schematics describing the subjects. (v) Able to apply the knowledge in a practical manner using detailed procedures.
<p>8. Remarks</p>	<p>Ref: HKAR-66 Module 12: Helicopter aerodynamics, structures and systems</p>