HE1 - Helicopter Engineering 1

From the MS HADA
(Helicopter, Aircraft and Drone Architecture)

Key elements

Period: **February to March**

Estimated duration: **90 hours**

For whom:
Recent graduates, jobseekers and experienced employees

Location:
AIRBUS HELICOPTERS, Marignane

Language: **English**

Highlights

- Rotorcraft flight mechanics & design
- Helicopter acoustics
- Materials & technology for helicopters
- Design & fatigue justification for helicopter

This certificate provides comprehensive insights and knowledge about helicopter dynamics, materials and technology.

Learning objectives

After completing this course, participants will be able to:

- Explain and discuss the aerodynamic principles of rotors, flight qualities, performance levels, noise pollution and pre-design methods.
- Describe vibratory and acoustic phenomena in depth under the aspects of stability, fatigue, monitoring for safety and onboard comfort optimization.
- Manage all general architecture aspects, especially sub systems integration constraints,
- Assess in depth sub systems functions and performances,
- Identify helicopter production materials and technologies,
- Implement stress calculation using Finite Element Method.

Prerequisites

- General knowledge in flight mechanics
- Basics of aerodynamics
- Basics of engineering

Information and registration

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Course content

THE1 – Helicopter understanding (31h):

- Introduction to rotorcraft
- Principles of helicopter Aerodynamics
- Introduction to rotor dynamics
- High-speed helicopters and hybrid configurations
- Rotorcraft pre-design methods
- Main rotor & tail rotor sizing
- Helicopter flight mechanics & handling qualities
- Helicopter performance assessment methods
- Flight & mission performance
- Rotorcraft noise certification
- Principles of rotorcraft aeroacoustics
- Main rotor noise, tail rotor noise, engine noise
- Ground noise footprint

THE2 – Helicopter dynamics (31h):

Helicopter vibrations:

- Rotor technologies & dynamics
- Structural dynamics
- Rotor balancing theory, rotor tuning methods
- Anti-Vibration device
- Impact of vibrations on Health and Comfort & on equipment reliability
- Health & Usage monitoring systems

Aeroelasticity and Aeromechanics instabilities:

- Flutter
- Rotor/fuselage couplings
- Ground & air resonance
- Rotor and fuselage sizing to avoid ground resonance - application
- Drive train torsional instability
- Shaft bending instability
- Active control of dynamic instabilities

Acoustics:

- Helicopter internal noise
- Noise measurements & reduction techniques
- Acoustics and psychoacoustic metrics, health impacts
- Noise sources (rotor noise, aerodynamic noise, mechanical noise)
- Diagnosis/identification of a noise problem
- Helicopter Acoustical simulation

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THE3 – Helicopter materials & technology (31h):

- Logic of evolution towards single rotor formula
- Architectural criteria
- Optimization paths for single rotor formula
- Structure technology - Landing gears
- Composite and metal structures
- Wheel and friction pad landing gears
- Blade technology
- Design criteria
- Rotor hub technology
- Anti-coupling rotor hubs
- Gear system mechanisms
- Architecture and motion of gearboxes
- Mechanical element stress & fatigue (metal parts)
- Theory and origin of fatigue on helicopter
- Stress calculation via Finite Element Method
- Key parameter driving fatigue limit
- Application to structures (sizing, Flight load measurement, bench test)
- Damage tolerance
- Composite materials and parts
- Comparison of composite and metal technologies
- Mechanical behavior and characteristics

Teaching methods

Teaching methods	Yes
Lectures / tutorial	X
Collaborative learning	
Flipped classroom	
Blended learning (online and face to face)	
Learning by doing	X
Project-based	
Simulation	
Case study	X

Assessment

Written exams