Helicopters

Course code: AHE2 — ECTS Credits: 1.5

Department	: ET	**Lectures**	: 12h30
Lecturers	: D. Bertin	**Tutorials**	:
	(guest speakers/ *extérieurs*)	**Laboratory sessions**	:
Year of study	: 1st year	**Project**	:
Semester	: 2nd semester	**Home works**	:
Assessment method(s)	: 1 written test	**Total hours**	: 12h30
Language of instruction	: English		
Type of courses	: Compulsory		

Objective: Understanding of flight mechanics specific to helicopters, as well as how is working a rotor. Understanding the ground resonance phenomena related to a rotor/structure coupling

Prerequisites: None

Content:

Part 1: Rotor and flight mechanics – Rotors' technologies

1. Rotor mechanics and helicopter flight mechanics: buffeting, drag equation, rotor hinges, rotor control (piloting), longitudinal and lateral balance of the aircraft in stationary mode and in horizontal flight position.
2. Ground resonance: phenomena description, fluid/structures coupling, description of the role of the frequency adaptors.
3. Rotors' technologies: give an overview of the concepts, the technologies and materials used for the main and tail helicopter rotors, for Eurocopter and other companies

Part 2: General architecture, design, survivability

1. Vehicle's general architecture: description of the different architectures (civil, military aircrafts), the main components, tracking, the networks and segregation principles
2. The structure and the « equipment » (fuel, gear, internal lay out, missions' options, air conditioning systems) : the constructive principles of the structures, and the technologies, the structure's equipments, their role, the design
3. The survivability: the concept of crash protection, the design
4. The general design in preliminary projects : rotors' design, performances
5. Dynamic units of helicopters (transmission, rotor), their role and design : parameters for rotors design, causes of static and fatigue resistance

Part 3: Helicopter flight performances

1. Presentation of the principle
2. Required power : Froude Theory, required power for stationary flights, required power in forward flight, reduced characteristic quantities: reduced mass /reduced power, required power distribution
3. Expendable power : engine power/Engine speeds, power loss upon installation, gearbox restrictions
4. Restrictions (flight envelope, Never exceed speed, MGW, reduced mass…)
5. Analysis of the specificities of the helicopter performances thanks a determined model
6. Presentation of the aspects of the take-off performances related while taking into account the engine failure: notions on height-velocity diagram and Fly-away, presentation of the performance class (JAR-OPS 3), procedures of associated take-off, analyses of the parameters that determine these performances
7. Presentation of the « mission's calculation » aspects : modelling, emphasis of the iteration process to be applied, Payload/Range chart, examples

Recommended reading: None

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