AVIO H3628: Helicopter Aerodynamics, Structures and Systems

Module Title:	Helicopter Aerodynamics, Structures and Systems
Language of Instruction:	English

Credits:	5

NFQ Level:	7

Module Delivered In	No Programmes

Teaching & Learning Strategies:	Lectures will be delivery using PowerPoint, handouts and interactive learning techniques.

Module Aim:	To give the student the competency and skills set for helicopter flight systems and principles of operation.

Learning Outcomes	
On successful completion of this module the learner should be able to:	
LO1	Discuss the principles and operation of helicopter flight control systems.
LO2	Demonstrate and illustrate the principles of blade tracking and the role of vibration analysis as a tool in vibration reduction.
LO3	Describe and explain the operation of the different types of helicopter transmission systems.
LO4	Describe the different types of aircraft structures and how they are applied in helicopter construction.
LO5	Describe and explain the different mechanical and electrical systems used on helicopters

Pre-requisite learning
Module Recommendations *This is prior learning (or a practical skill) that is recommended before enrolment in this module.*
No recommendations listed
Incompatible Modules *These are modules which have learning outcomes that are too similar to the learning outcomes of this module.*
No incompatible modules listed
Co-requisite Modules
No Co-requisite modules listed
Requirements *This is prior learning (or a practical skill) that is mandatory before enrolment in this module is allowed.*
No requirements listed

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Module Content & Assessment

Indicative Content
Flight Control Systems for Helicopters Cyclic control;Collective control ;Swash plate ;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.
Blade Tracking and Vibration Analysis Helicopter Rotor alignment Main and tail rotor tracking; Static and dynamic balancing; Vibration types, vibration reduction methods; Ground resonance.MEMS sensors, intermediate transmissions, UAV transmission systems, main rotor mast indication systems, HUMS
Helicopter Transmission Systems Gear boxes, main and tail rotors on helicopters ; Clutches, free wheel units and rotor brake. Tail rotor drive shaft flexible couplings, bearings, vibration dampers and bearing hangers
Helicopter Airframe Structures 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. 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.
Helicopter Air Conditioning systems Air Supply – Sources of air supply including engine bleed and ground cart Air conditioning Air conditioning systems for small, mid and large helcopters Distribution systems; Flow and temperature control systems; Protection and warning devices.
Helicopter Equipment and Furnishings Emergency equipment requirements; Seats, harnesses and belts; Helicopter cargo lifting systems Emergency flotation systems specific to helicopters Cabin lay-out, cargo retention; Equipment lay-out; Cabin Furnishing Installation. helicopter night flying systems, camera systems,
Helicopter Fire Protection systems Fire and smoke detection and warning systems on small to large helicopters Fire extinguishing systems; System tests.
Helicopter Fuel Systems System lay-out; Fuel tanks; Supply systems for piston and jet powered helicopters Dumping, venting and draining; Cross-feed and transfer; Indications and warnings; Helicopter Refuelling and defuelling
Helicopter Hydraulic Power Systems System lay-out on helicopters 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. Indication and warning systems
Ice and Rain Protection Systems for Helicopters Ice formation, classification and detection; Anti-icing and de-icing systems: electrical, hot air and chemical; Rain repellent and removal; Wiper systems Probe and drain heating.
Helicopter Landing Gear Construction, shock absorbing; Extension and retraction systems: normal and emergency; Indications and warning;Wheels, tyres, brakes;Steering;Air-ground sensing Skids, floats.for helicopters Wheels, tyres, brakes;slum pads
Pneumatic / Vacuum Systems for Helicopters System lay-out; Sources: engine, compressors, reservoirs, ground supply; Pressure control Distribution on differnet helicopter configurations Indications and warnings; Interfaces with other systems.
Integrated Modular Avionics (ATA42) for Helicopters 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.
Helicopter On Board Maintenance Systems (ATA45) Central maintenance computers; Data loading system; Electronic library system; Printing; Structure monitoring (damage tolerance monitoring).
Helicopter Information Systems (ATA46) 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 Aircraft General Information System;Helicopter Flight Deck Information System; Helicopter Maintenance Information System; Passenger Cabin Information System; Miscellaneous Information System.

Assessment Breakdown	%
Continuous Assessment	10.00%
Practical	20.00%
End of Module Formal Examination	70.00%

Continuous Assessment				
Assessment Type	*Assessment Description*	*Outcome addressed*	*% of total*	*Assessment Date*
Examination	Students will complete assignments as part of the assessment of this module.	1,3,5	10.00	Week 25

No Project

Practical				
Assessment Type	*Assessment Description*	*Outcome addressed*	*% of total*	*Assessment Date*
Practical/Skills Evaluation	The student will complete a number of assignments during the module and write a report on each assignment	1,2,3,4	15.00	n/a
Practical/Skills Evaluation	The student will complete al test during the module.	2,3,5	5.00	n/a

No End of Module Formal Examination

SETU Carlow Campus reserves the right to alter the nature and timings of assessment

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Module Workload

Workload: Full Time		
Workload Type	*Frequency*	*Average Weekly Learner Workload*
Lecture	Every Week	3.00
Laboratory	Every Week	1.50
Independent Learning Time	Every Week	2.00
	Total Hours	6.50