Module Specification

Aircraft Systems, Avionics and Control

Version: 2023-24, v2.0, 23 Mar 2023

Contents

Part 1: Information

Module title: Aircraft Systems, Avionics and Control

Module code: UFMFB7-30-2

Level: Level 5

For implementation from: 2023-24

UWE credit rating: 30

ECTS credit rating: 15

Faculty: Faculty of Environment & Technology

Department: FET Dept of Engineering Design & Mathematics

Partner institutions: None

Field: Engineering, Design and Mathematics

Module type: Module

Pre-requisites: None

Excluded combinations: None

Co-requisites: None

Continuing professional development: No

Professional, statutory or regulatory body requirements: None

Part 2: Description

Overview: The course covers aircraft systems, avionics and industrial control with illustrated practical and computational exercises so that students can gain a true feel of how aircraft avionics and systems are designed and operate as an integrated set of modules.

Features: Not applicable

Educational aims: This module aims to provide students with a detailed knowledge of aircraft systems and how avionics and control are integrated into the operation of an aircraft.

Outline syllabus: Aircraft Systems section includes:

Flight controls, flight instruments, landing gear, hydraulics, pneumatics, fuel, pressurisation, air conditioning, ice and rain protection, APUs, automatic flight, flight management computers, communications, navigation, emergency equipment, fire protection and warning systems.

Interpretation of cut-aways, schematics and circuit diagrams for aircraft systems.

Applicable regulations for certification and flight including FAA, JAR, CAA, and ATA.

Avionics section includes:

Design Concepts: Operability, maintainability, reliability, testability, flight criticality, fail safety.

Design Process: Configuration management, international standards and design verification.

Avionics (The commercial and military environment): Operational requirements and how they emerge. Product life cycle. Logistics and life cycle costs.

Avionics Systems Engineering: System partitioning, hardware and software integrity. Flight criticality. Data transmission standards and methods.

Avionics Design Process: Hard and software configuration control.

Avionics Systems: Radar (airborne systems), Radio (airborne communications systems), Navigation (long range, short range and terminal area guidance systems), Flight control (autostabilisers and autopilot systems), Sensors (attitude, position,

rate, air data, etc.), Displays (electromechanical, solid-state and head-up)

Industrial Control section includes:

Measurement and Electronics: Parameter measurement including position, speed, strain, temperature, light intensity. Introduction to electronic components (passive and active) with particular reference to sensor systems. Laboratory-based review of manual measurement (use of oscilloscopes, meters, DVMs, etc.). Basic computer interfacing, continuous and sampled systems, brief review of electronic integrated circuits including op-amps, A-D/D-A.

Electrical machines and drives: DC machines (characteristics - series, shunt, compound. Brushless DC motors), AC machines (basic characteristics, induction, synchronous), Stepper motors, DC motor/servo drive systems, bridge/ PWM, AC motor drives, induction, variable frequency, Stepper motor drives, Size/type for particular application, characteristics.

System Modelling: Modelling of simple linear systems as differential equations. Using the operator 's' (using cross discipline examples, i.e. electrical, mechanical, thermal, fluid, etc.). Use of the transfer function form for modelling. System classification. Introduction to state space techniques.

Closed and open loop: Introduction to feedback and its effect on system performance. Use of block diagrams. Manipulation and simplification using block diagram algebra.

System performance: Response of systems to standard inputs in the time domain (mathematically and using computer simulation packages). Correlation of system transfer function to position of poles and zeros on the 's' plane, consequent relationship to transient performance. Use of frequency response techniques, Bode and Nyquist plotting. Stability criteria. Determination of transfer functions from Bode plots and vice versa. Computer simulation of frequency domain performance.

Design for specific objectives: Compensation, two and three term controllers. Use of

various techniques to achieve desired performance, frequency response methods, root locus, etc. Use of simulation package(s) to design controllers.

Industrial controllers: Introduction to Programmable Logic Controllers (PLCs), ladder logic, high level schematic systems, PID modules.

Part 3: Teaching and learning methods

Teaching and learning methods: Scheduled learning includes lectures, seminars, tutorials, demonstration and practical classes and workshops.

Independent learning includes hours engaged with essential reading, case study preparation, assignment preparation and completion etc.

Module Learning outcomes: On successful completion of this module students will achieve the following learning outcomes.

MO1 Identify, classify and describe the performance of systems and components through the use of analytical methods and modelling techniques

MO2 Examine the process and standards within the aircraft industry for the development, testing and integration of each system into an aircraft

MO3 Analyse the design of avionics systems to achieve performance, operational and logistic requirements

MO4 Interpret and differentiate between data transmission standards and system partitioning in aircraft guidance, control and propulsion systems

MO5 Evaluate, design and implement solutions to aerospace vehicle control problems through appropriate methods and software.

Hours to be allocated: 300

Contact hours:

Independent study/self-guided study = 228 hours

Computer-based activities = 48 hours

Total = 300

Reading list: The reading list for this module can be accessed at readinglists.uwe.ac.uk via the following link https://uwe.rl.talis.com/modules/ufmfb7-30-2.html

Part 4: Assessment

Assessment strategy: The assessment for this module is as follows:

An end of module exam on Aircraft Systems and Avionics and Control to ensure that students demonstrate a detailed understanding of the theory underpinning this module.

Presentation arising from group case study which provides students with an opportunity to develop, implement and evaluate complex control algorithms for the automation of aircraft and avionics systems in simulation.

A peer review process will be applied to the group work assessment in accordance with the Department Group Work Policy.

Resit is the same as the first sit

Resit deliverable(s) will be scaled appropriately to group size and task complexity

Assessment tasks:

Presentation (First Sit)
Description: Group presentation
Weighting: 50 %
Final assessment: No
Group work: Yes
Learning outcomes tested: MO2, MO3, MO5

Examination (Online) (First Sit)

Description: Online Examination (24 hours)

Weighting: 50 %

Final assessment: Yes

Group work: No

Learning outcomes tested: MO1, MO2, MO3, MO4, MO5

Presentation (Resit)

Description: Group presentation

Resit deliverable(s) will be scaled appropriately to group size and task complexity

Weighting: 50 %

Final assessment: No

Group work: Yes

Learning outcomes tested: MO2, MO3, MO5

Examination (Online) (Resit)

Description: Online Examination (24 hours)

Weighting: 50 %

Final assessment: Yes

Group work: No

Learning outcomes tested: MO1, MO2, MO3, MO4, MO5

Part 5: Contributes towards

This module contributes towards the following programmes of study: