MODULE SPECIFICATION

Part 1: Information			
Module Title	Aircraft Systems, Avionics and Control		
Module Code	UFMFB7-30-2	Level	Level 5
For implementation from	2018-19		
UWE Credit Rating	30	ECTS Credit Rating	15
Faculty	Faculty of Environment & Technology	Field	Engineering, Design and Mathematics
Department	FET Dept of Engin Design & Mathematics		
Contributes towards			
Module type:	Standard		
Pre-requisites	None		
Excluded Combinations	None		
Co- requisites	None		
Module Entry requirements	None		

Part 2: Description
Educational Aims: In addition to the Learning Outcomes, the educational experience may explore, develop, and practise but not formally discretely assess the following: Awareness of professional literature IT skills in context Communication skills and working effectively in teams **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.

Teaching and Learning Methods: Contact: 72 hours
Assimilation and skill development: 88 hours
Coursework: 120 hours
Exam preparation: 20 hours
Total: 300 hours

Overview: The course aims to provide a basic education in 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.

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.

Part 3: Assessment

Component A consists of a two hour exam on Aircraft Systems and Avionics sections at the end of semester 1 and a two hour exam on the Industrial Control section at the end of semester 2.

Component B consists of an Aircraft systems and Avionics Project/Case study and an Industrial Control assignment. The Systems and Avionics group project provides students with an opportunity to undertake exploratory learning and present their findings as a group to their peers. The control assignment allows students to develop complex control algorithms to solve real control problems in simulation.

First Sit Components	**Final Assessment**	**Element weighting**	**Description**
Project - Component B		25 %	Project / case study
Project - Component B		25 %	Assignment
Examination - Component A		25 %	Examination 1 (2 hours)
Examination - Component A	✓	25 %	Examination 2 (2 hours)
Resit Components	**Final Assessment**	**Element weighting**	**Description**
Project - Component B		50 %	Assignment
Examination - Component A	✓	50 %	Examination (3 hours)

Part 4: Teaching and Learning Methods

Learning Outcomes

On successful completion of this module students will be able to:

	Module Learning Outcomes
MO1	Break down the composition of an aircraft in terms of its systems, and the function and design of each system and illustrate each major system by constructing a system diagram
MO2	Outline the advantages and disadvantages of current systems in terms of design, operation, suitability, maintenance and life cycle. Predict the likely evolution of such systems in the future

MO3	Examine the process and standards within the aircraft industry for the development, testing and integration of each system into an aircraft
MO4	Evaluate the suitability of a particular aircraft system for its role within a particular aircraft
MO5	Examine the fundamental operation and underlying technology behind modern radar, communication, navigation, flight control, display and sensor systems
MO6	Analyse the design of avionics systems to achieve performance, operational and logistic requirements
MO7	Interpret and differentiate between data transmission standards and system partitioning in aircraft guidance, control and propulsion systems
MO8	Analyse, demonstrate and categorise the dynamic behaviour of systems through mathematical models of real systems using appropriate simulation software (MATLAB/Simulink)
MO9	Assess the principles of operation of control technology and thus analyse their suitability for a given task
MO10	Apply automatic control theory during the design of controllers using a number of methods such as pole placement, to modify the dynamic behaviour of systems
MO11	Evaluate, design and implement solutions to real control problems
MO12	Demonstrate an understanding of the principles of operation of technology supporting such regimes, actuators and transducers

Contact Hours

Contact Hours	
Independent Study Hours:	
Independent study/self-guided study	228
Total Independent Study Hours:	228
Scheduled Learning and Teaching Hours:	
Face-to-face learning	72
Total Scheduled Learning and Teaching Hours:	72
Hours to be allocated	300
Allocated Hours	300

Reading List

The reading list for this module can be accessed via the following link:

https://uwe.rl.talis.com/modules/ufmfb7-30-2.html