UNIVERSITY OF HERTFORDSHIRE

Definitive Module Document

1 Module CODE	2 Titles: Short: Intro to Des Long: Introduction to Design			
1AAD0003				
3 Credit Points:	**4 ECTS Points:**	**5 Level:**	**6 Location:**	**7 Date first offered:**
15	7	1	UH HATFIELD	01/02/2004

8 Semester(s) in which the Module is approved to run: B

9 Home Department: AAD Aerospace, Automotive & Design

10 Departments Contributing to Teaching:

AAD 100%	0%	0%	0%	0%	0%
0%	0%	0%	0%	0%	0%

Total: 100 %

11 Module Aims:

The aims of this module are to enable students to . . .

* acquire skills in using and applying a CAD system
* produce and interpret engineering drawings in accordance with recognised standards, conventions and accepted practices
* understand and apply the process of design to engineering problems

12 Intended Learning Outcomes:

12a Knowledge and Understanding

Successful students will typically . . .

* standard conventions for engineering drawings
* the role and application of CAD tools in design
* the nature and application of the process of design

12b Skills and Attributes

Successful students will typically . . .

* use CAD tools to produce 3D models and drawings of a satisfactory solution to an identified requirement
* produce and interpret detailed drawings which communicate production requirements and comply with the relevant standards and conventions
* devise and present design solutions to specified requirements
* contribute to the design process as a member of a team

13 Modes of Delivery:

Delivery Mode:	Hours per	Lecture	Seminar/ Tutorial	Workshop/ Prac/Group	Indep	Fieldwork/ Prof Prac	Total hours:
Classroom-based		8	12	18	112	0	150

14 Module Content:

14a Module Content: (for publication, max 150 words)

This module introduces students to the process of engineering design, and to CAD tools for creating and documenting design solutions. The principles and standard practices of technical drawing and tolerancing are taught. The role and use of CAD in design is taught and practiced, both 3D solid modelling and 2D drafting. The nature of design as a structured process is considered, and demonstrated by students undertaking a variety of design exercise and assignments. The design activities are mostly done in small teams, thereby developing skills in teamwork, communication and leadership. There are staged assessments that require the students to present their work using a variety of methods and communication tools.

14b Module Content details: (supporting Learning Outcomes, max 250 words)

· use of CAD tools to prepare 3D models and 2D drawings
· principles and standard practices of technical drawing to recognised standards
· the design process
· design projects done in small teams, devising and presenting solutions to specified problems

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15 Language of Delivery: English **16 Language of Assessment:** Engli

17 Assessment Details

17a Assessment: (weighting and compulsory information, max 50 words)

Coursework: 100 % Exam 0 %

17b Further details: (max 200 words)

Assessments are through in-course assignments, both individual and small group

18 Pre and Co Requisite Note: tick if optional

Pre req:	☒	☒	☒	
Co req:	☐	☐	☐	Prohibited:

19 Subject Board of Examiners:

20 Programmes on which this Module is offered

*	EITSV	BSc (Hons) Motorsport Technology
*	EIP	Manufacturing Systems Engineering Degree
*	EITM	BSc Hons Technology with Management
*	EIME	BEng (Hons) Manufacturing Engineering
*	EICAE	BEng (Hons) Computer Aided Engineering
*	EIV	B.Eng(Hons) Automotive Engineering Degree
*	EIM	Mechanical Engineering Degree
*	EIASE	Aerospace Systems Engineering Degree
*	EIA	Aerospace Engineering degree
*	EIMENG	MEng Engineering

21 Previous Module this Module replaces:

22 Comments:

SIGNATURES: **Head of Department -** Date: 15

Faculty Registrar - Date: 19

Associate Dean Academic - Date: 16

FACULTY OF ENGINEERING AND INFORMATION SCIENCES

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Definitive Module Document

1 Module CODE	2 Titles: Short: Fluids & Thermo Long: Fluid Mechanics & Thermodynamics
1AAD0014	

3 Credit Points:	4 ECTS Points:	5 Level:	6 Location:	7 Date first offered:
15	7	1	UH HATFIELD	01/09/2004

8 Semester(s) in which the Module is approved to run: B

9 Home Department: AAD Aerospace, Automotive & Design

10 Departments Contributing to Teaching:

AAD 100%	0%	0%	0%	0%	0%
0%	0%	0%	0%	0%	0%

Total: 100 %

11 Module Aims:

The aims of this module are to enable students to . . .

* be introduced to fundamental concepts and definitions in Fluid Mechanics and Thermodynamics
* understand the application of the principles of Mechanics to Fluids
* be introduced to the first law of Thermodynamics and associated processes

12 Intended Learning Outcomes:

12a Knowledge and Understanding

Successful students will typically . . .

* identify the properties of liquids and gases
* identify thermodynamic systems and processes

12b Skills and Attributes

Successful students will typically . . .

* apply Fluid Mechanics principles to the analysis of fluid systems
* analyse Fluid Mechanics problems using dimensional analysis
* apply the first law of Thermodynamics to the analysis of open and closed systems
* apply the perfect gas concept to simple gaseous systems

13 Modes of Delivery:

Delivery Mode:	Hours per	Lecture	Seminar/ Tutorial	Workshop/ Prac/Group	Indep	Fieldwork/ Prof Prac	Total hours:
Classroom-based		33	20	3	94	0	150

14 Module Content:

14a Module Content: (for publication, max 150 words)

Properties of liquids and gases, Gauge and absolute pressure. Hydrostatic principles, manometry, forces on immersed surfaces. Definition of types of fluid flow. The mass conservation principle. The Euler-Bernoulli equation. Apllication of Bernoulli's equation to pipeline problems with energy losses and flow measurement. Momentum equation for steady flow. Dimensional analysis, Buckingham's method, non-dimensional coefficients.

The concept of a thermodynamic system, open and closed. Thermodynamic processes. Zeroth Law and concept of temperature. Thermodynamic work and heat, their equivalence and energy transfer. First law of thermodynamics, definition of internal energy and enthalpy. The specific heat capacities of perfect gases and their relevance to isentropic processes.

14b Module Content details: (supporting Learning Outcomes, max 250 words)

This module introduces students to the fundamentals of fluid flow and thermodynamics and provides a basis for higher level modules in aerothermodynamics, vehicle aerodynamics and thermofluid mechanics.
Lectures and tutorials are accompanied by laboratory sessions in fluid mechanics and thermodynamics.
Assessment is through laboratory reports, written coursework and an examination.

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15 Language of Delivery: English **16 Language of Assessment:** English

17 Assessment Details

17a Assessment: (weighting and compulsory information, max 50 words)

Coursework: 30 % Exam 70 %

17b Further details: (max 200 words)

Typically, assessment will consist of:
- Written coursework 15%
- Two laboratory practical reports 15%
- One 3-hour end of course unseen examination 70%

Overall pass required, subject to a maximum grade E2 if not both coursework and examinatin are passed

18 Pre and Co Requisite Pre req: ☐ ☐ ☐
Note: tick if optional Co req: ☐ ☐ ☐ Prohibited:

19 Subject Board of Examiners: AERO/CIVIL/MECH L1 COMMON

20 Programmes on which this Module is offered

*	EIMENG	MEng Engineering
*	EIASE	Aerospace Systems Engineering Degree
*	EIA	Aerospace Engineering degree
*	EIV	B.Eng(Hons) Automotive Engineering Degree
*	EIM	Mechanical Engineering Degree

21 Previous Module this Module replaces: 1ACM0003

22 Comments:

SIGNATURES: **Head of Department -** PRBuller Date: 15/7/04

Faculty Registrar - Date: 19/7/04

Associate Dean Academic - F. Vendl Date: 16/7/04

FACULTY OF ENGINEERING AND INFORMATION SCIENCES

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Definitive Module Document

1 Module CODE	2 Titles: Short: Mechanical Science Long: Mechanical Science
1AAD0019	

3 Credit Points:	4 ECTS Points:	5 Level:	6 Location:	7 Date first offered:
15	7	1	UH HATFIELD	01/09/2004

8 Semester(s) in which the Module is approved to run: B

9 Home Department: AAD Aerospace, Automotive & Design

10 Departments Contributing to Teaching:

AAD 100%	0%	0%	0%	0%	0%
0%	0%	0%	0%	0%	0%

Total: 100 %

11 Module Aims:

The aims of this module are to enable students to . . .

* develop an understanding of the principles of mechanics and application of the basic principles of structural analysis in determining the behaviour of simple structures and mechanisms.
* develop an understanding of fundamental principles of forces in equilibrium.

12 Intended Learning Outcomes:

12a Knowledge and Understanding

Successful students will typically . . .

* be able to explain the fundamental principles of forces in static and dynamic equilibrium
* be able to explain the principles of statics and dynamics and the behaviour of simple structures.

12b Skills and Attributes

Successful students will typically . . .

* apply fundamental principles of statics and dynamics to basic engineering components and assemblies.
* carry out simple vibrational analysis of mechanical structures.

13 Modes of Delivery:

Delivery Mode:	Hours per	Lecture	Seminar/ Tutorial	Workshop/ Prac/Group	Indep	Fieldwork/ Prof Prac	Total hours:
Classroom-based		39	13	4	94	0	150

14 Module Content:

14a Module Content: (for publication, max 150 words)

This course encompasses statics (fundamental concept of units, forces, force systems, free body diagrams, couples, moments, direct & shear stresses, beams, frames, shear force-bending moment relationships) and dynamics (quantities and concepts, linear & angular motion, non-constant acceleration, forces and torques, moment of inertia, application of free-body diagrams, work-energy equation, impulse-momentum equation, simple harmonic motion, dynamic mechanisms, engineering vibrations).

Please refer to the teaching plan for a more detailed description.

14b Module Content details: (supporting Learning Outcomes, max 250 words)

Dynamics
1. Linear & angular motion, expressed graphically. Constant acceleration equations.
2. Introduction to non-constant acceleration - use of acceleration-time graph.
3. Forces and torques (Newton's Laws of motion. Friction effects. Free-body diagrams. Use of graphical and analytical methods). Moment of inertia (Radius of gyration. Parallel axis theorem)
4. Further application of free-body diagrams to engineering systems involving linear and angular accelerations.
5. Work-Energy equation. Impulse-momentum equation for linear and angular systems.
6. Simple harmonic motion, single degree of freedom undamped systems in free vibration, introduction to damping.
7. Dynamic Mechanisms. Engineering vibrations.

Statics
1. Fundamental concepts and quantities (units, vector and scalar quantities). Fundamentals of forces and force systems (resolution of forces, triangle of forces), equilibrium, free body diagrams, couples & moments.
2. Direct and shear stresses in simple cases, shear distribution in beams, elementary bending theory.
3. Two-dimensional pin-jointed frames, shear force-bending moment relationships (using various loading cases - point & uniformly distributed loads), 3-pin arches.

Attendance. Full attendance and participation is anticipated in order to gain full benefit from the stated programme.

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15 Language of Delivery: English **16 Language of Assessment:** English

17 Assessment Details

17a Assessment: (weighting and compulsory information, max 50 words)

Coursework: 40 % Exam 60 %

Separate passes are required in both the coursework and examination elements of assessment.

17b Further details: (max 200 words)

Typically, assessment will consist of:

Two assessed laboratory, essay or phase test assignments, one from each of the titular component sections and valued at 20% each.

A written examination comprising unseen questions from each section.

Overall pass required, subject to a maximum grade of E2 if not both coursework and examination are passed.

18 Pre and Co Requisite Pre req: ☐ ☒ ☒

Note: tick if optional Co req: ☐ ☐ ☐ Prohibited:

19 Subject Board of Examiners:

20 Programmes on which this Module is offered

*	EICAE	BEng (Hons) Computer Aided Engineering
*	EIME	BEng (Hons) Manufacturing Engineering
*	EIV	B.Eng(Hons) Automotive Engineering Degree
*	EIM	Mechanical Engineering Degree
*	EIASE	Aerospace Systems Engineering Degree
*	EIA	Aerospace Engineering degree
*	EIMENG	MEng Engineering

21 Previous Module this Module replaces: 1AAD0001

22 Comments:

SIGNATURES: **Head of Department -** A Butler Date: 15/7/04

Faculty Registrar - Date: 19/7/04

Associate Dean Academic - F Wardle Date: 16/7/04

FACULTY OF ENGINEERING AND INFORMATION SCIENCES

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Definitive Module Document

1 Module CODE	2 Titles: Short: Avionics Systems Long: Avionics Systems			
2AAD0022				
3 Credit Points: 15	**4 ECTS Points:** 7	**5 Level:** 2	**6 Location:** UH HATFIELD	**7 Date first offered:** 01/09/2004

8 Semester(s) in which the Module is approved to run: B

9 Home Department: AAD Aerospace, Automotive & Design

10 Departments Contributing to Teaching:

AAD 100%	0%	0%	0%	0%	0%
0%	0%	0%	0%	0%	0%

Total: 100 %

11 Module Aims:

The aims of this module are to enable students to . . .

* understand the principles of aircraft navigation
* gain knowledge of the instruments/avionics systems used to navigate aircraft
* appreciate the wide range of electrical systems used by aircraft for non-navigational purposes.

12 Intended Learning Outcomes:

12a Knowledge and Understanding

Successful students will typically . . .

* be able to describe the essential instrument displays found on modern flight-decks.
* explain the principles of radio, radar and aircraft navigation

12b Skills and Attributes

Successful students will typically . . .

* research a technical topic, write a technical paper, and lead a short seminar

13 Modes of Delivery:

Delivery Mode:	Hours per	Lecture	Seminar/ Tutorial	Workshop/ Prac/Group	Indep	Fieldwork/ Prof Prac	Total hours:
Classroom-based		30	8	4	102	6	150

14 Module Content:

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14a Module Content: (for publication, max 150 words)

This module includes elements required for PPL - Ground School Training as well as Avionics Systems used by commercial and military aircraft.

PPL Ground School Topics - Principles of navigation, Flight Deck Instruments, Radio navigation systems, Primary and Secondary Radar, Radio telephony systems (including procedures for their use).

Non-PPL Ground School Topics - Long and Short Range Navigation Systems, Aircraft Electrical Systems, Communications Theory.

The module will consist of lectures on the basics principles, some laboratories using the flight simulator, industrial visits and student lead seminars.

14b Module Content details: (supporting Learning Outcomes, max 250 words)

Lecture content: delivered by UH staff and external speakers

1.Principles of navigation
2.Flight planning
3.Basic flightdeck instruments
4.Principles of radio transmission
5.Principles of radio reception
6.Radio Modulation methods
7.Principles of Radar
8.Primary and secondary radar
9.Air Traffic Control 10.Communication Procedures
11.Avionics Design Considerations

Laboratories
Students are expected to do two open access laboratories using the Merlin flight simulator with trained student operators. These experiments concern:
1. Basic flightdeck instruments
2. Navigation

Seminars:
Students will be expected to research one of the following topics, write a technical paper on the topic and give a short seminar on the topic to their fellow students.

VHF Direction Finding, Distance Measuring Equipment, Automatic Direction Finding Equipment, Non-Directional Beacons, VHF Omni-Range, UHF navigation systems, Global Positioning System, Instrument Landing Systems, Transponders, Weather Radar, Traffic Avoidance Systems, Long-Range navigation systems, Inertial Navigation Equipment, Head-Up Displays, Fly-by-wire/Fly-by-light, Flight Data Recorders, Aircraft Lighting, AC/DC power supplies, Electronic Counter Measures.

Industrial Visits
1. Air Traffic Control Centre
2. Aircraft maintenance facility

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15 Language of Delivery: English **16 Language of Assessment:** English

17 Assessment Details

17a Assessment: (weighting and compulsory information, max 50 words)

Coursework: 50 % Exam 50 %

Separate passes are required in both the coursework and examination elements of assessment

17b Further details: (max 200 words)

Typically, assessment will consist of:
- One 3-hour end-of-course examination (50%)
- One technical paper (30%)
- One oral presentation (20%)

18 Pre and Co Requisite Pre req: ☐ ☐ ☐
Note: tick if optional Co req: ☐ ☐ ☐ Prohibited:

19 Subject Board of Examiners: AERO/CIVIL/MECH ENG L2/3

20 Programmes on which this Module is offered

* EIMENG MEng Engineering
* EIASE Aerospace Systems Engineering Degree

21 Previous Module this Module replaces: 2ACM0004

22 Comments:

SIGNATURES: **Head of Department -** PR Buller Date: 15/7/04
Faculty Registrar - Date: 19/7/04
Associate Dean Academic - F Wendl Date: 16/7/04

FACULTY OF ENGINEERING AND INFORMATION SCIENCES

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Definitive Module Document

1 Module CODE	2 Titles: Short: MATLS & STRUCTURES 2 Long: MATERIALS AND STRUCTURAL MECHANICS
2ACM0002	

3 Credit Points:	4 ECTS Points:	5 Level:	6 Location:	7 Date first offered:
15	7	2	UH HATFIELD	22/09/97

8 Semester(s) in which the Module is approved to run: B

9 Home Department: AAD Aerospace, Automotive & Design

10 Departments Contributing to Teaching:

AAD 100%	0%	0%	0%	0%	0%
0%	0%	0%	0%	0%	0%

Total: 100 %

11 Module Aims:

The aims of this module are to enable students to . . .

* further their knowledge and understanding of mechanics, and apply it to practical situations
* select materials and their processing in a design situation, by matching properties of specific materials and treatments with engineering requirements

12 Intended Learning Outcomes:

12a Knowledge and Understanding

Successful students will typically . . .

* identify the theoretical response of engineering components to complex applied loading systems, and relate this to practical situations
* identify the range of materials available to the engineer
* recognise the relationship between microstructure and the properties of materials
* Students will be able to:
* understand the theoretical response of engineering components to complex applied loading systems, and how this relates to practical situations.

12b Skills and Attributes

Successful students will typically . . .

* apply analytical techniques to relatively complex assemblies of structural components
* implement such techniques in a Finite Element Analysis computer programme.
* select appropriate thermomechanical treatments for the modification of mechanical properties of materials

13 Modes of Delivery:

Delivery Mode:	Hours per	Lecture	Seminar/ Tutorial	Workshop/ Prac/Group	Indep	Fieldwork/ Prof Prac	Total hours:
Classroom-based		40	9	7	94	0	150

14 Module Content:

14a Module Content: (for publication, max 150 words)

1. 2D stress and strain analysis
2. Bending stresses in beams with unsymmetrical sections.
3. Complex shear analysis
4. Integration of moment equation for beam displacements
5. Fundamental Strut Theory
6. Structural Analysis of structures using matrix methods
7. MetalsFerrous and non-ferrous metals and alloys, and the thermomechanical treatments involved in their processing and strengthening
8. Engineering Polymers
9. Engineering Ceramics

14b Module Content details: (supporting Learning Outcomes, max 250 words)

1. 2D stress and strain analysis
Analysis of stress and strain in two dimensions, Poisson's ratio, Hooke's Law for 2-D stress, Mohr's stress circle. Rosette strain gauge analysis, Mohr's strain circle.

2. Bending stresses in beams with unsymmetrical sections.

3. Complex shear analysis
Idealised & thin-walled approach to shear analysis (flexural loading), complimentary action of shear, shear flow, shear stress in open and closed sections, shear centre calculation.

4. Integration of moment equation for beam displacements

5. Fundamental Strut Theory
Effects of support constraints and combined loads, instability of struts, Euler buckling theory, effect of end constraints, tangent modulus theory, eccentrically loaded struts, secant theory with methods of solution, reference to BS449.

6. Structural Analysis using matrix methods
Force method for analysis of determinate structures, matrix formulation of equilibrium equations, determination of structural stiffness applied to pin-jointed frameworks.
Displacement method for analysis of indeterminate structures, matrix formulation of compatibility equations, determination of structural flexibility, applied to pin-jointed frameworks.
The principle of virtual work, as an overview as applied to above frameworks.

7. Metals
Solidification of metals, and its effect on structures and properties. Theoretical strength, defects in structures, dislocations and strengthening mechanisms. Cold working, annealing, recrystallisation and hot working. Alloying of metals - phases, introduction to phase diagrams and their interpretation. Plain carbon steels, effect of composition and heat treatment on structure and properties. Alloy steels, their effect on hardenability, structure and properties, structural steels and stainless steels. Aluminium and titanium alloys in their cast, wrought and heat-treated forms. Solid solution hardening and precipitation hardening.

8. Polymers
Polymerisation, molecules, amorphous & crystalline polymers, copolymers. Mechanical behaviour of engineering plastics - elastic, glassy & rubber states, glass transition temperature, viscoelasticity, creep. Effects of additives, foams. Adhesives.

9. Ceramics
Types and applications of engineering ceramics, statistical nature of properties. Production processes.

Laboratory sessions:
- Solidification and casting - 2 hours
- Microstructures - 2 hours
- Instability and indeterminate structures (struts, pin-jointed frames) - 3 hours

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15 Language of Delivery: English **16 Language of Assessment:** English

17 Assessment Details

17a Assessment: (weighting and compulsory information, max 50 words)

Coursework: 30 % Exam 70 %

17b Further details: (max 200 words)

Typically, assessment will consist of:
One 3-hour end-of-course examination, with 50% materials and 50% structures content (70%)
Two 2-hour materials laboratory sessions, requiring one laboratory report (10%)·
One 3-hour structures laboratory session, requiring a laboratory report (10%)·
One phase test (10%)

Passes in both (i) coursework and (ii) overall performance are required.

18 Pre and Co Requisites Pre req: ☐ ☐ ☐
Note: tick if optional Co req: ☐ ☐ ☐ Prohibited:

19 Subject Board of Examiners: AERO/CIVIL/MECH ENG L2/3

20 Programmes on which this Module is offered

*	EIASE	Aerospace Systems Engineering Degree
*	EIV	B.Eng(Hons) Automotive Engineering Degree
*	EIM	Mechanical Engineering Degree
*	EIA	Aerospace Engineering degree
*	EIMENG	MEng Engineering

21 Previous Module this Module replaces:

22 Comments:

SIGNATURES: **Head of Department -** P R Butler Date: 15/7/04
Faculty Registrar - Date: 19/7/04
Associate Dean Academic - F. Vlado Date: 16/7/04

FACULTY OF ENGINEERING AND INFORMATION SCIENCES

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Definitive Module Document

1 Module CODE	2 Titles:			
3AAD0018	Short: Stability & Cont of Aircraft Long: Stability & Control of Aircraft			
3 Credit Points:	**4 ECTS Points:**	**5 Level:**	**6 Location:**	**7 Date first offered:**
15	7	3	UH HATFIELD	01/09/2004

8 Semester(s) in which the Module is approved to run: B

9 Home Department: AAD Aerospace, Automotive & Design

10 Departments Contributing to Teaching:	AAD 100%	%	0%	0%
	0%	0%	0%	0% **Total:** %

11 Module Aims:

The aims of this module are to enable students to . . .

* develop an understanding of the dynamics of rigid aircraft flight and of the significance of aircraft dynamic and stability characteristics in aircraft design.
* extend their knowledge of control systems and design simple controllers to modify an aircraft's natural modes of flight.

12 Intended Learning Outcomes:

12a Knowledge and Understanding

Successful students will typically . . .

* identify the natural modes of an aircraft and explain an aircraft's long term response to control inputs.

12b Skills and Attributes

Successful students will typically . . .

* apply analytical techniques to study the static and dynamic stability of an aircraft and its response to control inputs.
* design controllers to modify the speed, accuracy and damping of an aircraft's flight motion using both continuous and digital state space methods.
* use a computer to simulate the dynamics of an aircraft and the performance of a control system.

13 Modes of Delivery:

Delivery Mode:	Hours per	Lecture	Seminar/ Tutorial	Workshop/ Prac/Group	Indep	Fieldwork/ Prof Prac	Total hours:
Classroom-based		28	14	14	94	0	150

14 Module Content:

14a Module Content: (for publication, max 150 words)

1. Aircraft natural modes
2. Linearised aircraft equations of motion
3. Aerodynamic derivatives
4. Analytical solution of aircraft equations of motion
5. Long term effects of controls
6. Aircraft static stability
7. State space modelling of aircraft
8. Stability of state space models
9. Control using state space methods
10. Principles of digital control
11. Control using digital state space methods

14b Module Content details: (supporting Learning Outcomes, max 250 words)

1. Aircraft natural modes (10%) - physical description; influence of aircraft design on their characteristics.

2. Formulation of linearised aircraft equations of motion. (10%) - Longitudinal and lateral equations of motion

3. Aerodynamic derivatives (10%) - Definition; effects of aircraft design; introduction to experimental methods to determine them.

4. Analytical solutions of aircraft equations of motion. (10%) - Identification of natural modes from their solution. Approximate solutions and assessment of their accuracy.

5. Long term effects of controls. (5%) - Response of aircraft to thrust and elevator changes; steady turns; sideslipping motion.

6. Aircraft static stability. (5%) - Derivation of condition for longitudinal static stability and elevator angle to trim. CG margin and neutral point.

7. State space modelling (15%) - State and output matrix equations. Simulation of aircraft using state space models. Transfer function matrix, characteristic equation, Routh stability criterion.

8. Control using state space methods (15%) - State controllability and observability, canonical forms. State feedback and state estimators to modify the natural modes of an aircraft.

9. Principles of digital control (5%) - Difference equations, z-transforms, A/D and D/A covertors and zero order hold model .

10. Digital state space methods (15%) - digital form of state space models, digital state and time response, stability of digital state space models, digital canonical forms, design of controllers using digital state feedback and digital state estimation

Computer simulation software and controller design packages will be used throughout the course.

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15 Language of Delivery: English **16 Language of Assessment:** English

17 Assessment Details

17a Assessment: (weighting and compulsory information, max 50 words)

Coursework: 40 % Exam 60 %

17b Further details: (max 200 words)

Typically, assessment will consist of:
One 3-hour end-of-course examination (60%)
One laboratory based assignment (10%)
One 1-hour written phase test (10%)
One 2-hour computer based phase tests (10%)
Two asessed tutorial poblems (10%)

Passes in both (i) coursework and (ii) overall performance are required

18 Pre and Co Requisites: Note: tick if optional

Pre req:	☐	☐	☐	☐
Co req:	☐	☐	☐	☐
Prohibited:				

19 Subject Board of Examiners: AERO/CIVIL/MECH ENG L2/3

20 Programmes on which this Module is offered:

*	EIMENG	MEng Engineering
*	EIASE	Aerospace Systems Engineering Degree
*	EIA	Aerospace Engineering degree

21 Previous Module this Module replaces: 3ACM0010

22 Comments:

Signatures:

Head of Department - PRBuller Date: 15/7/04

Faculty Registrar - Date: 19/7/04

Associate Dean Academic - F. Hendl Date: 16/7/04

FACULTY OF ENGINEERING AND INFORMATION SCIENCES

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Definitive Module Document

1 Module CODE	2 Titles: Short: AERO STRUCT DES & AN Long: AEROSPACE STRUCTURAL DESIGN AND ANALYSIS
3ACM0012	

3 Credit Points:	4 ECTS Points:	5 Level:	6 Location:	7 Date first offered:
15	7	3	UH HATFIELD	22/09/97

8 Semester(s) in which the Module is approved to run: B

9 Home Department: AAD Aerospace, Automotive & Design

10 Departments Contributing to Teaching:

AAD 100%	0%	0%	0%	0%	0%
0%	0%	0%	0%	0%	0%

Total: 100 %

11 Module Aims:

The aims of this module are to enable students to . . .

* develop their understanding upon which aerospace structures are designed and analysed.
* develop an understanding of the airworthiness requirement for aircraft design.

12 Intended Learning Outcomes:

12a Knowledge and Understanding

Successful students will typically . . .

* identify the principles of aerospace structural design.
* identify the principle airworthiness requirements for the design and loading of aircraft.

12b Skills and Attributes

Successful students will typically . . .

* use classical techniques to obtain closed form solutions to thin-walled structures and therefore validate finite element analysis results to simplified structural component.
* apply computational techniques such as finite element methods to analyse the crashworthiness of aircraft structures.

13 Modes of Delivery:

Delivery Mode:	Hours per	Lecture	Seminar/ Tutorial	Workshop/ Prac/Group	Indep	Fieldwork/ Prof Prac	Total hours:
Classroom-based		36	26	8	80	0	150

14 Module Content:

14a Module Content: (for publication, max 150 words)

1. Flight and gust envelopes
2. Manoeuvre loading on aircraft structures
3. Landing load on aircraft structures
4. Fatigue life predictions and load cycle counting methods
5. Safe-life, fail-safe and damage tolerance
6. Finite element stiffness formulation
7. Numerical FE Techniques
8. Introduction to rigid body dynamics
9. Buckling analysis of light reinforced compression skin panels
10. Modes of failure of thin plates under combined loads
11. Stress analysis of thin-walled structures
12. Idealisation of closed section box sections
13. Shear loading of symmetric and non-symmetric box sections
14. Shear, bending and torsion of fuselage structures
15. Load re-distribution in the region of cut-outs of thin-walled structures

14b Module Content details: (supporting Learning Outcomes, max 250 words)

1. Flight and gust envelopes
Introduction to the airworthiness requirements such as JAR-25 for aircraft design and the method of plotting the envelopes.

2. Manoeuvre loading on aircraft structures
Introduction to the load (factors) acting on the aircraft structures in level, pull-out and banked turn flight conditions

3. Landing load on aircraft structures
Based on energy theory, introduce the forces acting on aircraft components through the main landing gear of different efficiency at a design sink speed.

4. Fatigue life predictions and load cycle counting methods
Introduction to the Palmgren-Miner's law used for fatigue life prediction of structures under programme loading.Introduction also to the methods of alternating load measurement and load-cycle counting (rain-flow counting).

5. Safe-life, fail-safe and damage tolerance
Introduction to the safe-life design requirement started in 1950s and the development of fail-safe design and damage tolerance requirements. Calculation of crack growth with load cycles based on fracture mechanics.

6. Finite Element Stiffness Formulation
Introduction to simple 2D spar and beam elements. Extension to 2D membrane elements

7. Numerical FE Techniques
Numerical integration techniques. An awareness of the Jacobian transformation technique.Appreciation of the inaccuracies due to ill-conditioned matrix. Assembly and application of boundary conditions.

8. Rigid Body Dynamics
Introduction to a rigid body dynamics such as MADYMO to study the survivability during a helicopter crash situation.

9-10. Buckling analysis of light reinforced compression skin panels under combined loads
Introduction to the energy theory applied to the calculation of buckling stress and margin of safety of a plate under various loads. Introduction also to a quick method using design curves and preliminary sizing of a compression skin-stringer panel.

11-12. Stress analysis of idealized thin-walled structures
Starting from introducing the shear flow in a closed and open section thin-walled structure under torsion and shear loads, extend the analysis to idealized closed-section thin-walled structures.

13-14. Shear loading of non-symmetric box structures and the effect of taper and variable stringers;
Extend the method of shear flow calculation for a symmetric section to a structure with non-symmetric section, tapered section and variable size of stringers.

15. Shear, bending and torsion of fuselage structures
Further extend the application of shear flow calculation to fuselage structures

16. Load re-distribution in the region of cut-outs of thin-walled structures
Introduction to the method of calculating stress around the cut-outs of a closed-section thin-walled structure

UNIVERSITY OF HERTFORDSHIRE

Definitive Module Document

15 Language of Delivery: English **16 Language of Assessment:** English

17 Assessment Details

17a Assessment: (weighting and compulsory information, max 50 words)

Coursework: 40 % Exam 60 %

17b Further details: (max 200 words)

Typically, assessment will consist of:
One 3-hour end-of-course examination. (60%)
Two coursework assignments requiring two coursework reports (36%)
Attendance at lectures and tutorials (4%)

Passes in both (i) coursework and (ii) overall performance are required

18 Pre and Co Requisites Pre req: ☐ ☐ ☐
Note: tick if optional Co req: ☐ ☐ ☐ Prohibited:

19 Subject Board of Examiners: AERO/CIVIL/MECH ENG L2/3

20 Programmes on which this Module is offered

* EIMENG MEng Engineering
* EIA Aerospace Engineering degree

21 Previous Module this Module replaces:

22 Comments:

SIGNATURES: **Head of Department -** PR Buller Date: 15/7/04

Faculty Registrar - Date: 19/7/04

Associate Dean Academic - F. Hall Date: 16/7/04

FACULTY OF ENGINEERING AND INFORMATION SCIENCES

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Definitive Module Document

1 Module CODE	2 Titles:	
3ACM0014	Short: LOGISTICS ENG	
	Long: LOGISTICS ENGINEERING	

3 Credit Points:	4 ECTS Points:	5 Level:	6 Location:	7 Date first offered:
15	7	3	UH HATFIELD	22/09/1997

8 Semester(s) in which the Module is approved to run: B

9 Home Department: AAD Aerospace, Automotive & Design

10 Departments Contributing to Teaching:

AAD 100%	0%	0%	0%	0%	0%
0%	0%	0%	0%	0%	0%

Total: 100 %

11 Module Aims:

The aims of this module are to enable students to . . .

* recognise the concepts of logistics as they apply to various types of equipment used in the aerospace industry
* become familiar with the current American and European logistics standards
* be familiar with mathematical and computer modelling techniques with the aid of bespoke logistics software

12 Intended Learning Outcomes:

12a Knowledge and Understanding

Successful students will typically . . .

* identify the role of computer systems and related standards and practices in the efficient operation of logistical support
* recognise the effects of system and subsystem reliability on system availability and spares provisioning
* recognise the wide variety of factors affecting system availability, usability, maintainability and safety

12b Skills and Attributes

Successful students will typically . . .

* evaluate the effects of system and subsystem reliability on system availability and spares provisioning
* determine the effects of spares costs, transportation times and availability on system reliability
* describe the effects of natural and induced environments on system performance, reliability and operating costs

13 Modes of Delivery:

Delivery Mode:	Hours per	Lecture	Seminar/ Tutorial	Workshop/ Prac/Group	Indep	Fieldwork/ Prof Prac	Total hours:
Classroom-based		25	10	2	113	0	150

14 Module Content:

14a Module Content: (for publication, max 150 words)

This course examines the concepts of logistics and logistics engineering as they apply to various types of equipment and systems used in the defence and aerospace industry, and to introduce mathematical and computer modelling techniques with the aid of bespoke logistics software. It considers failure rates, repair rates, maintainability and safety issues, and their desired effects on equipment design. It also examines the regulatory requirements for both civil and military applications.

14b Module Content details: (supporting Learning Outcomes, max 250 words)

1.Introduction to life-cycle costs of Aerospace equipment. Minimising total, rather than manufacturing, costs.
2.Historical background to Logistics. Definitions of subsistence, operations and hardware logistics, Statistical methods and planning for random events.
3.Accounting methods and life-cycle costing. Cost estimating, discounting and inflation.
4.Logistics Support Analysis (LSA) in design requirements and tasks. The impact of LSA on product support and life-cycle costs.
5.Supportability and environmental design factors. Design for safety, reliability, maintainability and testability. Condition monitoring. MANPRINT.
6.Failure Mode, Effects and Criticality Analysis (FMECA). Requirements for a Logistic Support Analysis Record (LSAR).
7.Manufacturing logistics. Achieving reliability and maintainability predictions. Subcontracting and risk-sharing in manufacturing.
8.Decisions on procurement. Evaluating alternatives. Integrated Logistics Support (ILS). Scheduled and unscheduled maintenance. Planning for failures. Failure reporting analysis.
9.Logistics modelling: repair levels and Level Of Repair Analysis (LORA), cost effective spares provisioning and life- cycle cost.
10.Availability modelling and operating factors, optimisation software (e.g. OPUS, EDCAS)
11.Retirement and disposal. Scrap and re-sale values. Reassessment of product design or procurement policies.
12.The iterative ILS/LSA process. Presentation of reports.

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15 Language of Delivery: English **16 Language of Assessment:** English

17 Assessment Details

17a Assessment: (weighting and compulsory information, max 50 words)

Coursework: 40 % Exam 60 %

17b Further details: (max 200 words)

Typically, assessment will consist of:

Three independent assignments (40%)
One unseen three-hour examination (60%)

There is no requirement for passes in both coursework and examination elements of assessment

18 Pre and Co Requisite Note: tick if optional

Pre req:	☐	☐	☐	
Co req:	☐	☐	☐	Prohibited:

19 Subject Board of Examiners: AERO/CIVIL/MECH ENG L2/3

20 Programmes on which this Module is offered

*	EITM	BSc Hons Technology with Management
*	EIMENG	MEng Engineering
*	EIASE	Aerospace Systems Engineering Degree

21 Previous Module this Module replaces:

22 Comments:

SIGNATURES: **Head of Department -** PRBuller Date: 15/7/04

Faculty Registrar - Date: 19/7/04

Associate Dean Academic - F. Mead Date: 16/7/04

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Definitive Module Document

1 Module CODE	2 Titles:	
3MSE0031	Short: Rel Eng Long: Reliability Engineering	

3 Credit Points:	4 ECTS Points:	5 Level:	6 Location:	7 Date first offered:
15	7	3	UH HATFIELD	01/09/2003

8 Semester(s) in which the Module is approved to run: B

9 Home Department: AAD Aerospace, Automotive & Design

10 Departments Contributing to Teaching: AAD 100% 0% 0% 0%
0% 0% 0% 0% 0% **Total: 100 %**

11 Module Aims:

The aims of this module are to enable students to . . .

* evaluate the reliability techniques relating to engineering
* select and summarise the suitability of reliability techniques for different application

12 Intended Learning Outcomes:

12a Knowledge and Understanding

Successful students will typically . . .

* compare and relate Weibull modelling methods to engineering
* compare and relate Experimental Design to engineering

12b Skills and Attributes

Successful students will typically . . .

* select and organise a range of techniques for determining reliability
* contrast and evaluate a range of experimental design techniques

13 Modes of Delivery:

Delivery Mode:	Hours per	Lecture	Seminar/ Tutorial	Workshop/ Prac/Group	Indep	Fieldwork/ Prof Prac	Total hours:
Classroom-based		24	12	0	114	0	150

14 Module Content:

14a Module Content: (for publication, max 150 words)

This module covers two principal areas: firstly, Weibull Analysis and the associated support material (Load Strength analysis, redundancy, Extreme and Hazard Analysis). The second part is that of experimental design. This is divided into statistical experimental design, and Taguchi Analysis.

14b Module Content details: (supporting Learning Outcomes, max 250 words)

This subject is taught with a variety of teaching methods. Lectures are used to introduce core material. This is further explored with tutorial, seminars and case studies as in-class execrises to highlight overlapping material. Practical demonstrations and simulation packages are used.

- Failures (types of failure; complete, partial sudden) (5%)

- Reliability as a function of time (5%)

- Failure rates with time (bath tub curve) (5%)

- Failure distributions (normal, exponential, Weibull) (10%)

- Relationships between Z(t), F(t), R(t) (5%)

- Weibull - plotting at calculations from failure data (20%)

- Redundancy - types (series and parallel). Improving reliability. Calculating stand by requirements (10%)

- Extreme value, sudden death testing and hazard plotting (5%)

- Load-Strength Analysis (loading roughness, safety margins (5%)

- Design of Experiments. Full and fractional factorials. Effects and interactions (30%)

Reading List

O'Connor, P Practical Reliability Engineering, 3rd Ed. Wiley, (1998)
Montgomery, D, design and Analysis of Experiments, Wiley (1997)
Leemis, L, Reliability, Perntice Hall, (1995)
Kales, P Reliability, Prentice Hall, (1998)

UNIVERSITY OF HERTFORDSHIRE

Definitive Module Document

15 Language of Delivery: English **16 Language of Assessment:** English

17 Assessment Details

17a Assessment: (weighting and compulsory information, max 50 words)

Coursework: 50 % Exam 50 %

17b Further details: (max 200 words)

Typically, assessment will consist of:

One assignment
One unseen examination

Both coursework and unseen examination must be passed
Each assessment satisfies a selection of the learning outcomes

18 Pre and Co Requisites: Note: tick if optional

Pre req:	None	☐	☐	☐	☐
Co req:	None	☐	☐	☐	☐
Prohibited:	None				

19 Subject Board of Examiners: BUS/MGMT/QUAL COURSES (AADE)

20 Programmes on which this Module is offered

*	EITM	BSc Hons Technology with Management
*	IDKST	Combined Modular Scheme Honours Degree
*	EIME	BEng (Hons) Manufacturing Engineering
*	EICAE	BEng (Hons) Computer Aided Engineering
*	EIP	Manufacturing Systems Engineering Degree

21 Previous Module this Module replaces:

22 Comments:

Signatures:

Head of Department - PRBuller Date: 15/7/04

Faculty Registrar - Date: 19/7/04

Associate Dean Academic - Date: 16/7/04

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