UNIVERSITY OF HERTFORDSHIRE

Definitive Module Document

1 Module CODE	2 Titles:			
1PAM0013	Short: An. Tech. 1 Long: Analytical Techniques 1			
3 Credit Points:	**4 ECTS Points:**	**5 Level:**	**6 Location:**	**7 Date first offered:**
30	15	1	UH HATFIELD	24/09/2004

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

9 Home Department: PAM Physics, Astronomy & Mathematics

10 Departments Contributing to Teaching: PAM 100 % 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 the fundamental mathematical techniques required for engineering applications and develop the mathematical concepts required to support other modules in the engineering programmes.

12 Intended Learning Outcomes:

12a Knowledge and Understanding

Successful students will typically . . .

* LO1 - recognise elementary engineering functions
* LO2 - recognise matrix operations
* LO3 - recognise the use of calculus for engineering functions.

12b Skills and Attributes

Successful students will typically . . .

* LO4 - perform operations on standard mathematical expressions
* LO5 - apply calculus techniques to engineering functions
* LO6 - use a suitable software applications package to solve engineering problems.

UNIVERSITY OF HERTFORDSHIRE

Definitive Module Document

13 Modes of Delivery:

Delivery Mode:	Hours per	Lecture	Seminar/ Tutorial	Workshop/ Prac/Group	Indep	Fieldwork/ Prof Prac	Total hours:
Classroom-based		75	13	12	200	0	300

14 Module Content:

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

1. elementary functions: trigonometric, logarithmic, exponential
2. complex numbers
3. power series
4. matrix and vector algebra
5. eigenvalues and eigenvectors
6. Boolean algebra
7. differentiation and integration
8. ordinary differential equations
9. data handling and probability
10. use of a suitable software applications package such as MATLAB.

Refer to the teaching plan for a more detailed description.

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

1. elementary functions: trigonometric, logarithmic, exponential graphs and inverse functions
2. algebra of complex numbers
3. power series
   binomial theorem and Taylor series
4. matrices and vectors
   matrix algebra, inverse matrix, vector algebra
5. eigenvalues and eigenvectors
   characteristic equation
6. Boolean algebra
   truth tables
7. differention and integration
   elementary rules, fundamental theorem of calculus, stationary points, partial differentiation
8. ordinary differential equations
   first order equations and second order equations with constant coefficients
9. data handling and probability
   collecting and organising data, normal distribution

Learning Outcomes are assessed by:
LO1 - Test, LO2 - Examination, LO3 - Examination, test and Matlab, LO4 - Test and Examination, LO5 - Test, Matlab and Examination, LO6 - Matlab.

Laboratory sessions:
use of applications package such as MATLAB 12 hours

Indicative learning resources
Engineering Mathematics, Fifth edition, K Stroud and D Booth, Palgrave, 2002
Modern Engineering Mathematics, G James et al., Prentice-Hall, 2001, LRC Ref. 510.2462MOD
Engineering Mathematics Through Applications, K Singh, Palgrave 2003.

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 %

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

17b Further details: (max 200 words)

Coursework 10% Test
Matlab 20% - student participation and workbook
Matlab 10% - solve a realistic engineering problem.

18 Pre and Co Requisites: Note: tick if optional

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

19 Subject Board of Examiners: MATHEMATICS LEVEL 1 COURSES

20 Programmes on which this Module is offered

	IDCATUG	Credit Accumulation & Transfer Scheme - Undergraduate
	EIV	B.Eng(Hons) Automotive Engineering Degree
	EIMENG	M Eng Engineering
	EIME	BEng (Hons) Manufacturing Engineering
	EIM	Mechanical Engineering Degree
	EIEE	Electrical and Electronic Engineering Degree
	EICAE	BEng (Hons) Computer Aided Engineering
	EIASE	Aerospace Systems Engineering Degree
*	EIA	Aerospace Engineering degree

21 Previous Module this Module replaces: 1MAT0019

22 Comments:

Additional information:
18 Pre-requisite: A-Level Mathematics or equivalent required

Signatures:

Head of Department - Ala Davis Date: 31/03/04

Faculty Registrar - Date: 2/4/04

Associate Dean Academic - F Hadli Date: 31/3/04

FACULTY OF ENGINEERING AND INFORMATION SCIENCES

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UNIVERSITY OF HERTFORDSHIRE

Definitive Module Document

1 Module CODE	2 Titles: Short: Aerothermo & Design Long: Aerothermodynamics & Design			
2AAD0019				
3 Credit Points:	**4 ECTS Points:**	**5 Level:**	**6 Location:**	**7 Date first offered:**
30	15	2	UH HATFIELD	01/09/2004

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

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 . . .

* understand the laws, principles and methods of analysis in aerothermodynamic systems
* use appropriate methods of experimental investigation in aerothermodynamics
* understand the physics of boundary layers and compressible flows in order to evaluate the flow parameters and aerodynamic forces around a wing.
* recognise the role of design in the aerospace industry, particularly with respect to typical aerospace sub-assemblies, features and systems.
* understand the behaviour of ideal and real gases.
* understand the second law of thermodynamics, concept of entropy, principles of operation of heat engines and heat pumps.
* understand the behaviour of compressible flows in nozzles and diffusers under various flow speed conditions.
* understand the phenomenon of normal and oblique shock waves and expansion waves.
* be aware of the relevant airworthiness requirements and other aerospace data, their application and influence on design

12 Intended Learning Outcomes:

12a Knowledge and Understanding

Successful students will typically . . .

* analyse aerodynamic forces encountered in aircraft flight
* understand the growth of boundary layer and viscous drag
* model the flow around the aircraft
* understand the factors affecting the design of aircraft
* deal with problems involving ideal and real gases
* understand the practical implications of the second law of thermodynamics and concept of entropy
* recognise the limitations of heat engines efficiency and heat pumps coefficient of performance
* demonstrate an ability to deal with compressible flow in a variety of aerospace applications
* resolve problems involving normal and oblique compression and expansion waves
* demonstrate an awareness of the implications of their designs on weight, cost and complexity
* show an understanding of the fundamental operation of a variety of aircraft and missile systems

12b Skills and Attributes

Successful students will typically . . .

* analyse and calculate the aerodynamic forces including viscous drag
* model the wing vortex system and calculate the lift and vortex drag
* produce the aerodynamic design criteria for wings fitted to different aircraft
* plan and test a model of an aircraft in a wind tunnel to obtain the performance characteristics
* calculate fundamental gas parameters in various engineering applications
* analyse and characterise the performance of heat pumps and heat engines
* test and determine the performance characteristics of a typical heat pump in a laboratory environment
* calculate compressible flow and design parameters of nozzles and diffusers under various flow speed conditions
* analyse problems involving flow compression and expansion
* follow basic aerospace engineering design practice
* select appropriate materials for designed components
* select and specify appropriate bought-out components and units

13 Modes of Delivery:

Delivery Mode:	Hours per	Lecture	Seminar/ Tutorial	Workshop/ Prac/Group	Indep	Fieldwork/ Prof Prac	Total hours:
Classroom-based		56	20	28	196	0	300

14 Module Content:

UNIVERSITY OF HERTFORDSHIRE

Definitive Module Document

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

Aerodynamics
Aerofoil and wing geometry. Lift generation. Aerodynamic forces and moments. Wing characteristics. Effect of aspect ratio. International atmosphere. Speed measurement, IAS, TAS, EAS.
Wing vortex system, downwash and vortex drag. Viscous boundary layers, transition and separation. Viscous drag.
High lift devices. Aerodynamic drag and its estimation. Condition for minimum drag.
Aerodynamic design criteria for wings used in different aircraft.
Wind tunnel testing. Simulation of Reynolds number and Mach number.

Thermodynamics
Perfect, semi perfect and real gases. Enthalpy and internal energy of gases.
The second law of thermodynamics and its applications. Principle of heat engines and heat pumps. Clasius and Kelvin-Planks statements of the second law. Normal and reversed Carnot cycles. Entropy and the principle of increased entropy. Introduction to compressible flows. Stagnation and static properties of flowing flows. The speed of sound and the flow Mach number. Compressible flows in variable cross sectional area ducts (nozzles and diffusers).
Introduction to Compression and expansion waves. Normal and oblique shock waves. Variation of flow parameters across the waves. Waves tables. Expansion waves and flow parameters. DesignDesign of typical aerospace engineering assemblies etc. for specific functions, based on common aerospace practice. Selection of standard aerospace components - weight, function, reliability and fitness for purpose.
Examples:
Design of mounting arrangements for a guided-weapon sub-assemblyHydraulic circuit layout and component design

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

Aerodynamics
Measurement of speed. Determination of pressure distribution, lift and drag using results from wind tunnel tests. Modelling of wing vortex system to evaluate the aerodynamic forces. Determination of spanwise variation of incidence for a given wing loading . Calculation of viscous drag, determination of criteria for transition and separation.
Appreciation of changes in wing characteristics fitted with high lift devices.
Calculation of different components of aerodynamic drag. Determination of lift, drag, and speed corresponding to the condition of minimum drag.
Testing of a model aircraft in a wind tunnel to obtain its performance characteristics. Appreciation of problems associated with wind tunnel testing.
Review of factors considered in the aerodynamic design of wings used in different aircraft.

Thermodynamics
Determination of perfect and semi perfect gases properties.
Determination of Heat pumps and Heat engines coefficient of performances and efficiencies. Calculations of entropy changes in various gaseous systems. Appreciation of the use of a combination of heat engines and pumps for refrigeration and power production purposes. Calculation of the work output and rate of heat transfer in heat engines and pumps.Calculations of compressible flow parameters, including stagnation parameters, in various aerospace applications. Appreciation of the use of nozzles and diffusers in aerospace applications. Calculation of the flow parameters in variable cross sectional area ducts under variable flow speed conditions.
Calculations of the Mach Number, entropy change and other flow parameters across normal and oblique shock waves.
Calculation of the flow parameter across an expansion (Prandtl-Meyer) wave.

Design
A series of lectures covering the design of major aircraft structure and systems, including detailed descriptions of the function s of principal components.
A series of assignments covering a range of drawing skills and techniques in accordance with BS308.
Two major design tasks of escalating complexity, with appropriate guidance and support.

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 %

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
2 phase tests
2 laboratory reports
two assessed drawings plus one design test

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

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

21 Previous Module this Module replaces: 2AAD0003

22 Comments:

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

Faculty Registrar - Date: 19/7/04

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

FACULTY OF ENGINEERING AND INFORMATION SCIENCES

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Definitive Module Document

1 Module CODE	2 Titles: Short: Dyn, Inst & Cont Long: Dynamics, Instrumentation and Control Systems
2ACM0059	

3 Credit Points:	4 ECTS Points:	5 Level:	6 Location:	7 Date first offered:
30	15	2	UH HATFIELD	01/09/01

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

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 understanding of the principles of dynamics.
* perform simple experiments to measure the performance of mechanical systems.
* model/simulate the dynamic performance of mechanical systems
* modify the dynamic performance of mechanical systems using feedback and simple controllers
* design simple controllers to control mechanical systems

12 Intended Learning Outcomes:

12a Knowledge and Understanding

Successful students will typically . . .

* explain the fundamental principles of dynamics.
* explain how simple transducers and actuators operate.

12b Skills and Attributes

Successful students will typically . . .

* use laboratory equipment to measuring the performance of mechanical systems
* use mathematical models and computer simulation to predict the dynamic performance of systems and modify using feedback and simple controllers

13 Modes of Delivery:

Delivery Mode:	Hours per	Lecture	Seminar/ Tutorial	Workshop/ Prac/Group	Indep	Fieldwork/ Prof Prac	Total hours:
Classroom-based		60	26	14	200	0	300

14 Module Content:

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

1. Kinematics - Velocity and acceleration analysis
2. Kinetics - Dynamic force analysis of mechanisms. Transmission of forces and power. Balance of rotating and reciprocating systems. Gyroscopic motion.
3. Vibration - Damping. Analysis of free, and forced vibrations of single degree of freedom damped systems. Vibration isolation. Experimental analysis of vibrations. Transient responses for various excitations
4. Instrumentation - Revision of circuit analysis techniques, dimensional and error analysis. General operation and performance of transducers. Signal conditioning, amplification and noise considerations
5. Actuators - Electric Motors
6. Systems Modelling - 1st & 2nd order models of sub-systems. Transfer Functions & Block diagrams. Computer Simulation and time response.
7. Control Systems - Unity Feedback Control. Steady State Performance and Stability. Root Locus Plots. Simple series controllers.

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

1. Kinematics (10%) -Velocity and acceleration analysis of mechanisms including the Coriolis component of acceleration, by the use of simple analysis and graphical methods.

2. Kinetics (20%) - Dynamic force analysis of mechanisms. The transmission of forces and power through mechanisms and machines. Balancing of rotating and reciprocating systems. Principles and applications of gyroscopic motion

3. Vibration (20%) - Description of various forms of damping. Analysis of free and forced vibrations of single degree of freedom systems possessing viscous damping. Vibration isolation of forces and motion. Transient responses for various excitations including impulse and general functions. Experimental techniques of measurement.

4. Instrumentation (15%) - Revision of circuit analysis techniques, dimensional analysis, and error analysis. General operation and performance of transducers for static and dynamic instrumentation systems e.g. gyroscopes, accelerometers, thermocouples, pressure sensors, etc. Signal conditioning, amplification and noise considerations

5. Actuation (5%) - Electric Motors; AC, DC, stepper, PWM, Power control motors.

6. Systems Modelling (15%) - Derivation of first and second order differential equations to model simple mechanical systems. Transfer Functions. Block diagrams. Computer Simulation and time response.

7. Control Systems (15%) - Unity Feedback Control philosophy. Steady State Performance and Stability of Closed loop systems. Drawing of Root Locus Plots. Simple series controllers, P, PI, PD PID, Lead/Lag. Computer simulation software and controller design packages will be used throughout the course.

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%)
- 4 coursework assignments (15%)
- 4 phase tests (15%)
- laboratory logbook (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

*	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 -** PRBuller Date: 15/7/04

Faculty Registrar - Date: 19/7/04

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

FACULTY OF ENGINEERING AND INFORMATION SCIENCES

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Definitive Module Document

1 Module CODE	2 Titles:	
3AAD0015	Short: Ind Placement	
	Long: Industrial Placement	

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

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

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 awareness of the influence of external factors on the operation of the industry
* develop communication skills within an industrial environment
* develop practical skills for problem solving

12 Intended Learning Outcomes:

12a Knowledge and Understanding

Successful students will typically . . .

* demonstrate an understanding of the organisation of the company, products and markets served, and external factors influencing the operations of the company

12b Skills and Attributes

Successful students will typically . . .

* demonstrate effective use of IT tools through preparation of technical documentation
* demonstrate effective communication skills through reports, presentations and group work
* demonstrate acquisition and application of skills appropriate t the local/placement needs
* critically appraise the relevance of the Placement Year to his/her programme of study and own professional development.

13 Modes of Delivery:

Delivery Mode:	Hours per	Lecture	Seminar/ Tutorial	Workshop/ Prac/Group	Indep	Fieldwork/ Prof Prac	Total hours:
Work-based Learning		0	0	0	0	1200	**1200**

14 Module Content:

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

The optional professional placement year is undertaken between the second and final years of study.
Students undertake the placement within a commercial organisation that is able to provide an appropriate learning experience within an engineering environment.
The placement must be of at least 36 weeks duration though many students will complete a year or more at the company.
To be eligible for placement students must have achieved sufficient credit at Levels 1 and 2 to be able to enter the final year upon completion of the placement.
While the faculty/school actively supports the placements process ultimately it is the placement company that will select students, normally through an interview process.
During the placement a member of the academic staff will be assigned to the student as a tutor and will monitor the student's progress during the placement period.

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

Engineering Placement students will be expected to be exposed to a wide variety of industrial practices; typically these may include some or all of the following:

- Working within a production and assembly environment

- Work scheduling, planning and control

- Design and or test of product or manufacturing process

- Quality Engineering issues relevant to the company

- Computer Aided Engineering Tools and practices

- Working on assignments that involves cross functional communication and team work.

The students would be expected to demonstrate both diverse and in depth application of some of the above, but not necessarily all.

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: 100 % Exam 0 %

17b Further details: (max 200 words)

Students are expected to submit a Logbook and Report and must attain a Pass.

18 Pre and Co Requisite Note: tick if optional

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

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

20 Programmes on which this Module is offered

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

21 Previous Module this Module replaces: 3MSE0042

22 Comments:

Students must submit a logbook and a report and attain a pass.

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

Faculty Registrar - Date: 19/7/04

Associate Dean Academic F. Veeh Date: 16/7/04

FACULTY OF ENGINEERING AND INFORMATION SCIENCES

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Definitive Module Document

1 Module CODE	2 Titles: Short: Ind Major Project Long: Individual Major Project
3AAD0016	

3 Credit Points:	4 ECTS Points:	5 Level:	6 Location:	7 Date first offered:
30	15	3	UH HATFIELD	01/09/2004

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

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 . . .

* plan, organise and excecute an individual programme of work related to chosen field's of study, requiring the critical review of a subject area, analysis and synthesis of results, alternatives or concepts, the use of problem solving skills, the demonstration of initiative and evidence of original thought.
Students are required to demonstrate their communications skills by presenting their work both orally and in the form of a written technicalreport.

12 Intended Learning Outcomes:

12a Knowledge and Understanding

Successful students will typically . . .

* develop an in-depth awareness of the principle underpinning a specified topic which they work on
* demonstrate their knowledge of the engineering applications in the field of study of their project
* discuss the benefits and limitations of various approaches to overcoming the problem at hand

12b Skills and Attributes

Successful students will typically . . .

* demonstrate their ability for original and innovative work
* plan, structure and organise a programme of work and deliver outputs according to a predetermined timescale
* show how the analysis and synthesis results, alternatives or concepts can be used for the purpose of problem solving
* prepare, present and defend reports orally and in writing

13 Modes of Delivery:

Delivery Mode:	Hours per	Lecture	Seminar/ Tutorial	Workshop/ Prac/Group	Indep	Fieldwork/ Prof Prac	Total hours:
Distributed/distance (resource-based		1	9	0	290	0	300

14 Module Content:

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

The final year project embraces the aims of the programme and, in particular, will embody the principles of engineering applications.
It comprises a supervised investigation of an engineering problem that may take a design, experimental, analytical or commercial character, or combiniations of these facets.

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

The final year project comprises a supervised investigation on a topic that is defined in the project specification, and agreed between the student and the supervisor.
Each project will be different from the other projects conducted by students in the same cohort.
The project will normally be analytical and investigative in nature but may also be an in depth investigation into the scientific, technoological, environmental or socio-economical aspects of aerospace, mechanical, production, design, manufacturing or automotive engineeirng.
It will be undertaken individually.

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: 100 % Exam 0 %

17b Further details: (max 200 words)

Typically assessment will consist of:

Mid project review - 20%
Presentatin and project report - 80%

It is a requirement that students submit themselves for assessment in all of the above elements.
In addition students are required to achieve at least a minimum pass mark in the project report in order to pass the module as a whole.

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
*	EIA	Aerospace Engineering degree
*	EIV	B.Eng(Hons) Automotive Engineering Degree
*	EICAE	BEng (Hons) Computer Aided Engineering
*	EIME	BEng (Hons) Manufacturing Engineering
*	EIP	Manufacturing Systems Engineering Degree

21 Previous Module this Module replaces: 3ACM0015

22 Comments:

SIGNATURES: **Head of Department -** PRBuller Date: 15/7/04
Faculty Registrar - Date: 19/7/04
Associate Dean Academic - F. Hardy Date: 16/7/04

FACULTY OF ENGINEERING AND INFORMATION SCIENCES

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Definitive Module Document

1 Module CODE	2 Titles: Short: Aero Perf, Prop & Design Long: Aerospace Performance, Propulsion & Design			
3AAD0017				
3 Credit Points:	**4 ECTS Points:**	**5 Level:**	**6 Location:**	**7 Date first offered:**
30	15	3	UH HATFIELD	01/09/2004

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

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 in-depth understanding of the theory and practices associated with the design and performance analysis of aircraft and their propulsion devices.
* be introduced to the fundamentals of rocket performance and satellite dynamics.
* experience the process of producing preliminary designs for a whole aircraft through group activity.
* develop a professional attitude and critical approach to the application of engineering knowledge and skills.

12 Intended Learning Outcomes:

12a Knowledge and Understanding

Successful students will typically . . .

* identify the design and operational factors governing the performance of an aircraft
* recognise the relationship between the design and performance of gas turbine engine components.
* show an awareness of the principal regulatory requirements on the design of aircraft
* demonstrate a detailed understanding of one major area of aircraft design

12b Skills and Attributes

Successful students will typically . . .

* perform calculations necessary to assess an aircraft's performance
* analyse and optimise the performance of multi-stage rockets. Analyse satellite orbital motions.
* analyse the performance of an aircraft gas turbine engine and its prime components
* apply conduction, convection and radiation heat transfer algorithms to solve thermal analysis problems
* make an effective and sustained contribution to the working of a design team
* select appropriate materials, processes and bought-out components and systems appropriate to a major aircraft structure
* show an ability to work within constraints such as cost, weight and performance requirements
* contribute to a seminar presentation of major work areas undertaken

13 Modes of Delivery:

Delivery Mode:	Hours per	Lecture	Seminar/ Tutorial	Workshop/ Prac/Group	Indep	Fieldwork/ Prof Prac	Total hours:
Classroom-based		42	38	130	90	0	300

14 Module Content:

UNIVERSITY OF HERTFORDSHIRE

Definitive Module Document

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

Performance
1. Atmosphere properties and air speed definitions
2. Straight and level flight
3. Range
4. Climbing flight
5. Accelerated flight
6. Standardised performance
7. Single and multi-stage rocket performance; satellite orbital dynamics

Propulsion
1. Development and variants of gas turbine engines
2. Gas turbine component design and performance characteristics. Intakes; axial & centrifugal compressors; combustion chambers; turbines; exhaust systems; engine systems
3. Gas turbine performance
   a. Design point
   b. Off-design
4. Principles of conduction, convection & radiation heat transfer

Design
As part of a small group, undertake the design of a complete aircraft to meet a given specification. Each member will fulfil a distinct role, and will contribute to the progress of the team. By the end of the course, the team will produce a detailed technical report and a seminar presentation.

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

Performance
1. International standard atmosphere, speed measurement, TAS and EAS.
2. Straight and level flight. the drag polar, minimum power and drag conditions, flight envelope.
3. Climb rate prediction. Simplifying assumptions; conditions for maximum climb rate and climb angle; time to height; acceleration effects; energy height method.
4. Range prediction; Breguet range equations; conditions for maximum range.
5. Accelerated flight; take-off and landing performance.
6. Standardised performance; application to range optimisation.
7. Single and multi-stage rocket performance; benefits of multi-staging; launcher optimisation.
8. Satellite dynamics. The two-body problem; the Hohmann transfer; orbit inclination changes

Propulsion
1. Development and variants of gas turbine engines
2. Gas turbine component design and performance characteristics.
   a. Intakes (subsonic & supersonic)
   b. Axial & centrifugal compressors (including velocity diagrams)
   c. Combustion chambers
   d. Turbines (including velocity diagrams)
   e. Exhaust systems (nozzles, thrust reversers & reheat)
   f. Engine systems (air, oil, thermal)
3. Gas turbine performance
   a. Design point (including full engine performance cycle syntheses)
   b. Off-design (altitude, AIT, aircraft speed)
4. Principles of conduction, convection & radiation heat transfer
   a. Practical heat transfer problem solving

Design
Each group will comprise a number of students each with responsibility for a particular aspect of the overall design (e.g. wing design, undercarriage design). Additional duties may be required during the project, to meet the overall objectives.
Typically, projects will include:
1. Market trends, costs and legal requirements
2. aircraft configuration, aerodynamics and performance
3. engine selection, performance, installation, services
4. structural design of primary aircraft components
5. aircraft systems, including control systems, electrical and hydraulic supplies, mission-specific equipment

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: 70 % Exam 30 %

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 (30%)
One piece of performance coursework (6%)
One piece of propulsion coursework (6%)
One performance and propulsion phase test (8%)
Design project peer phase assessments, seminar presentation and report (50%)
Design project seminar presentations (10%)
Design project report (16%)

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

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

21 Previous Module this Module replaces: 3AAD0001

22 Comments:

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

Faculty Registrar - Date: 19/7/04

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

FACULTY OF ENGINEERING AND INFORMATION SCIENCES

APPROVED