Aerospace Engineering Premaster Programme

(Schakelprogramma)

for HTO Engineers and Industrial Engineers

2008-2009

1 Premaster programme

1.1 General information

Welcome to the Faculty of Aerospace Engineering!

In this document you will find detailed information about the HTO premaster programme. This document is supplementary to the BSc and MSc study guides and the digital study guide. These information resources and a lecture schedule for the programme are available on the Aerospace Engineering Student Portal at http://lr.students.tudelft.nl

The premaster programme is open to:

- Students who hold a B. Eng. Degree in Mechanical Engineering, Marine Technology or Civil Engineering. These students attend both the core programme and the complementary programme.
- Industrial Engineers who have graduated in Electromechanics (Oostende, Antwerpen, Leuven, Diepenbeek, Brussel). These students attend both the core programme and the complementary programme.
- Students who hold a B. Eng. Degree in Aeronautics (Luchtvaarttechnologie) from Hogeschool InHolland. These students attend the core programme only.
- Students who hold a B.Eng degree in Aviation (Hogeschool Amsterdam). These students attend the core programme only.
- Selected students from the Aeronautics programme (Hogeschool InHolland). These students attend the core programme as part of their InHolland curriculum.

All other HTO-students have to enroll in the regular BSc programme.

The faculty has appointed a premaster mentor, Ms. Yaela Borrenbergs, who will help you to start your studies effectively and who will familiarize you with the university. She will do this by organizing regular meetings. You can email her at: Y.M.M.A.Borrenbergs@tudelft.nl

1.2 Admission to the MSc programme

Only students who have completed the premaster programme are accepted into the master programme. A completed premaster programme grants access to all Aerospace Engineering master tracks.

All HTO premaster students will receive a study progress evaluation at the end of the year (based on the results up to the June examination period) concerning the continuation or discontinuation of their studies.

1.3 Study Programme

The programme comprises 44 ECTS and consists of a core programme and a complementary programme. The table on the next page gives an overview of the courses in the programme and the period planning. Furthermore, this guide contains the course descriptions of the core courses.

1.3.1. Course and Exam regulations

The course and exam regulations of the regular MSc programme in AE apply to the premaster as well, with the exception of:

- Course and Examination Regulations: Article 3, 4, 5, and 8.
- Rules and Directives: Article 11, 12 and 14
- For Rules and Directives Article 12 please read:

  The premaster programme is completed when one has received pass grades for all course units, or one has received a ‘fail’ for one course unit at the most, provided this fail grade is not for a course unit worth more than 5 credits, the grade obtained is not lower than 5.0 and the course unit is not a practical.

These regulations can be found on: www.lr.tudelft.nl/boardofexaminers

1.3.2. Core programme

The Board of Examiners of the Faculty of Aerospace Engineering has approved the following Premaster programme for 2008-2009:

Core programme		Period-1	Period-2	Period-3	Period-4	ECTS
AE2-110	Aerodynamics B	4+workshops ****)				3
AE2-522 I	Aircraft Structural Analysis I				4*)	3
AE2-S02	Space Eng. &Tech. II	4	4			6
AE3-302	Flight Dynamics I			6		4
AE3-914	Dynamics and Stability			4*)		3
IN1278LR	Intro Computer Programming				2	3
IN1278PR	Practical Intro Computer Programming				7 shifts	
WI1152th	Analysis for BSc. part 1	4				3
WI1153th	Analysis for BSc. part 2		4			3
WI1154th	Analysis for BSc. part 3			4		3
WI2256th	Lin. Algebra. / Diff. Equations	4	4			6
WM0203LR	Oral Presentation in English **)				2	2
Complementary programme						
LT3	Airplane Performance and Gas Turbines				4	5
LT3PR	Practical Airplane Performance and Gas Turbines				7 shifts	
						44

Program overview

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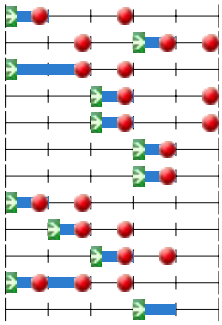
Year	**2008/2009**
Organization	**Luchtvaart- en Ruimtevaarttechniek**
Education	**Pre-Master Aerospace Engineering**

Code	Omschrijving	ECTS	p1 | p2 | p3 | p4 | p5
Core programme			
AE2-110	Aerodynamics B	3	
AE2-522 I	Aircraft Stuctural Analysis I	3	
AE2-S02	Space Engineering and Technology II	6	
AE3-302	Flight Dynamics I	4	
AE3-914	Dynamics and Stability	3	
IN1278LR	Introduction to Computer Programming	0	
IN1278PR	Introduction to Computer Programming (Lab)	3	
WI1152th	Analysis for B.Sc. part 1	3	
WI1153th	Analysis for B.Sc. part 2	3	
WI1154th	Analysis for B.Sc. part 3	3	
WI2256th	Linear Algebra and Differential Equations for TH-engineers	6	
WM0203LR	Oral Presentation	0	



AE2-110	Aerodynamics B	3
Responsible Instructor	Dr.ir. B.W. van Oudheusden	
Contact Hours / Week x/x/x/x	4/0/0/0	
Education Period	1	
Start Education	1	
Exam Period	1 3	
Course Language	English	
Required for	Follow up courses AE2-125 AE3-151	
Expected prior knowledge	AE1-020 I (Or equivalent, Chapter 1 of the course book).	
Parts	Lecture and study material contents: 1. Fundamentals; Basic concepts and flow equations (Ch.1+2); week 1-2. 2. Potential flows in 2D and 3D (Ch.3+6); weeks 3-4. 3. Airfoil theory (Ch.4); week 5-6. 4. Wing theory (Ch.5); week 6-7.	
Course Contents	Derivation of the basic flow equations; fundamental concepts; potential flows in two and three dimensions, airfoil and wing theory for inviscid, incompressible flow.	
Study Goals	At the end of this course the student knows the elementary concepts and the mathematical models which describe fluid flows. The focus is on the mathematical description of flows under the approximation of incompressible, inviscid flow conditions (potential flow). In particular, one should be able to calculate the pressure distribution, lift and pitching moment of airfoils (thin-airfoil theory) and the lift distribution and induced drag of wings(lifting-line theory).	
Education Method	Lecture	
Literature and Study Materials	J.D. Anderson, Fundamentals of Aerodynamics, McGraw-Hill, 2nd ed ISBN 0071007679, (Chapter 1-6) Additional Course Notes (on Chapters 4 and 5) - available on Blackboard Collection of Problem Exercises - available on Blackboard Homework Exercises - available on Blackboard. Solutions will be discussed in the lectures and later published on BB. Previous Exams + Solutions - available on Blackboard	
Assessment	Written	
Permitted Materials during Tests	The exam is closed book. The use of a basic calculator is permitted (required). The use of any additional material (books, lecture notes, formula sheets, electronic storage) is strictly forbidden!	
Remarks	The set of problem exercises and other documentation, such as updated info about the course, is available through Blackboard.	

AE2-522 I	Aircraft Stuctural Analysis I	3
Responsible Instructor	Ir. J. de Vries	
Contact Hours / Week x/x/x/x	0/0/0/4	
Education Period	4	
Start Education	4	
Exam Period	2 4 5	
Course Language	English	
Expected prior knowledge	AE1-914 is recommended.	
Course Contents	1. Introduction to linear theory of elasticity. 2. Stress vs displacement formulation, bi-harmonic equation, plane stress examples. 3. Engineering bending theory. 4. Including modulus weighted section properties. 5. Engineering torsion theory. 6. St. Venants theory, the warping function, Prandtls stress function, torsion of closed thin-walled tubes with singly or multiply connected cross-sections, the membrane analogy. 7. Stresses caused by transverse shear loading. 8. Shearing stresses in open and closed simply and multiply connected thin-walled cross-sections, position of the shear center. 9. Stresses in tapered box-beams. 10. Idealization of thin-walled shell structures. 11. Effect of wing and fuselage cut-outs.	
Study Goals	The course is designed to provide the students with a solid foundation to carry out analytical stress analysis of thinwalled aerospace structures. The course relies heavily on the fundamental concepts of structural mechanics taught in the first year courses Statics and Mechanics of Materials. In all cases treated the students are provided with techniques which enable them to carry out the stress analysis on representative aerospace structures encountered during the preliminary design phase.	
Education Method	Lecture	
Literature and Study Materials	T.H.G. Megson, Aircraft structures for engineering students. Fourth Edition	
Assessment	Written	
Remarks	Extra information can be found at the blackboard site.	

AE2-S02	Space Engineering and Technology II	6
Responsible Instructor	Ir. B.T.C. Zandbergen	
Instructor	Prof.dr. E.K.A. Gill	
Instructor	Ir. E. van Kampen	
Instructor	Dr.ir. E.L. Jansen	
Instructor	Prof.dr.ir. R. Benedictus	
Instructor	Ir. J.J. Wijker	
Contact Hours / Week x/x/x/x	4/4/0/0	
Education Period	1 2	
Start Education	1	
Exam Period	2 3	
Course Language	English	
Required for	Follow up courses AE3-803	
Expected prior knowledge	Students must have mastered the contents of the 1st-year course Space Engineering and Technology I (AE1-801)	
Parts	The lectures will be given in the following order: PART A (36 hours) Introduction (1 hours) Structures (3 hours) Thermal Control (4 hours) Attitude Control (6 hours) Power systems (6 hours) Telecommunication (4 hours) Command and Data Handling (4 hours) Propulsion (8 hours) PART B (20 hours) Systems engineering (3 hours) Mission Concept Exploration (2 hours) Vehicle Design and Sizing (6 hours) Launch Vehicle Selection (2 hours) Cost analysis (2 hours) Reliability analysis + Risks (3 hours) MAIT + Logistics (2 hours)	
Course Contents	Space Engineering and Technology II is divided into two parts: Part A deals with Space Vehicle Technology and Part B with Space Vehicle Engineering. Contents of part A: The following spacecraft subsystems are discussed: Structures, Thermal Control, Attitude Control, Power, Telecommunication, Command and Data Handling, and Propulsion. Of each of the subsystems we discuss: Functions, Options, Components, Attributes, and Design Synthesis. Contents of part B: Systems Engineering, Space Mission Concept Exploration, Design and Sizing of Satellite Bus, Launch Vehicle Selection, Cost and Risk, Manufacturing, Assembly, Integration,and Testing.	
Study Goals	Purpose of the courses Space Engineering and Technology I, II and III is to provide the aerospace engineering student with the means to perform a first design of a space system and more specific a space vehicle. Space Engineering and Technology II aims to broaden the students knowledge of spacecraft and spaceflight elements, and prepares them for participation in the 2nd-year study project and (a space variant of) the 3rd-year Design/Synthesis exercise. After this course, students shall be able to: list and describe: - the various applications of space systems and their importance, - the various elements/subsystems that make up a space system/spacecraft and their main function(s), - the various (future) options (architecture/components) that exist to perform this function, an array of specific desirable attributes to which the various options can be traded, determine a numerical value for each of the attributes, using data bases or simple experimental/theoretical modelling, perform system/spacecraft engineering to a level of detail sufficient to accomplish a feasible space system and more specific a spacecraft, perform subsystem engineering to a level of detail sufficient to accomplish a feasible subsystem including requirement generation, trades, budgets, test and verification.	
Education Method	Lecture	
Literature and Study Materials	P. Fortescue, J.Stark, Spacecraft systems engineering, Wiley, 2003, 3rd ed. ISBN 0471952206 J.R. Wertz, W.J.Larson, Space mission analysis and design, Kluwer, Deventer, 1999, 3rd ed. ISBN stud. ed 0792359011 Space Engineering and Technology, lecture notes AE2-S02 (Version 2005-2006). Workbook AE2-S02 (Version 2005-2006)	
Assessment	Written examination (85% of grade) + 4 tests via blackboard (15%).	
Set-up	The lectures are given by internal specialists in the field of spacecraft design and spaceflight mechanics.	

AE3-302	Flight Dynamics I	4
Responsible Instructor	Prof.dr.ir. J.A. Mulder	
Instructor	Ir. A.C. in 't Veld	
Contact Hours / Week x/x/x/x	0/0/6/0	
Education Period	3	
Start Education	3	
Exam Period	3 5	
Course Language	English	
Required for	Follow up courses AE4-301 AE4-303 AE4-304 AE4-305	
Expected prior knowledge	ae2-115 is recommended.	
Course Contents	1. Introduction to flight dynamics, flying qualities, static and dynamic stability. 2. Definitions, reference frames, Euler angles, quarternions, transformations. 3. Nonlinear equations of motion of rigid aircraft and spacecraft, effect of rotors, flat and spherical earth. 4. Linearized equations of motion for small excursions from nominal flight conditions, dimensionless and dimensional forms of the linearized equations of motions. Decomposition in longitudinal and lateral-directional equations, definition of stability and control derivatives. 5. Analysis of longitudinal aerodynamic forces and moments in symmetrical flight, contributions of wing, fuselage, tailplanes and engines, aerodynamic centre, down wash and control hinge moments. Moment equilibrium, the normal force on the horizontal tail to trim. 6. Estimation of longitudinal stability and control derivatives. 7. The concept of static stability in symmetrical steady flight conditions, the neutral point with stick fixed and stick free, stability margins. Elevator control force and displacement curves, relation with stability margins. Stick force and displacement stability. The manoeuvrepoint with stick fixed and stick free. Stick force and stick displacement per g. Artificial stability augmentation through springs and bobweights or artificial stability through Fly by Wire flight control systems. 8. Estimation of lateral stability and control derivatives. 9. Lateral stability and control in steady asymmetrical straight flight conditions and during turns. Control and equilibrium of one engine out flight, minimum control speed air. 10. Symmetrical characteristic motions, effect of nominal flight condition, altitude and speed. Simple approximations of short period and phugoïd characteristic motions. 11. Asymmetrical characteristic motions, effect of nominal flight condition, altitude and speed. Simple approximations of Dutch Roll, spiral mode and roll mode characteristic motions. The lateral stability diagram for the Dutch Roll and spiral modes.	
Study Goals	Thorough introduction to aircraft flight dynamics, stability and control. Nonlinear and linearized equations of motion. The concept of and conditions for static stability and static control characteristics. Mechanical and electronic control augmentation. Egine out flight conditions. Symmetrical and asymmetrical characteristic motions. Handling qualities requirements.	
Education Method	Lecture	
Literature and Study Materials	J.A. Mulder, W.H.J.J. van Staveren, J.C. van der Vaart, E. de Weerdt, Flight Dynamics, Lecture-Notes AE3-302	
Assessment	Written	

AE3-914	Dynamics and Stability	3
Responsible Instructor	Prof.dr.ir. M.A. Gutierrez De La Merced	
Contact Hours / Week x/x/x/x	0/0/4/0	
Education Period	3	
Start Education	3	
Exam Period	3 5	
Course Language	English	
Expected prior knowledge	AE2-914, WI2 029LR, WI1 276LR, WI1 277LR.	
Course Contents	Principles of dynamics: Newtons laws, motion with respect to non-inertial reference frames, fictitious forces, conservative systems, phase portraits, virtual work. Lagrangian dynamics: Generalised coordinates, constraints, generalised momenta, generalised forces, Lagrange equations of motion, Lagrangian function, conservative and dissipative systems, constraint forces, Lagrange multipliers, integrals of motion, Jacobi energy function, ignorable coordinates, steady motion. Stability: Definitions, stability of linearised systems, application to mechanics and steady motion. Variational analysis: Euler-Lagrange equation, natural boundary conditions, Hamiltons principle, Ritz method. Dynamics of rotating bodies: Kinematics, inertia tensor, Eulers equations of motion, moment-free motion, Euler angles, gyrodynamics, steady precession.	
Study Goals	To provide the student a background in the advanced methods of mechanics and their application to phenomena relevant to aerospace engineering.	
Education Method	Lecture	
Literature and Study Materials	J.S. Török, Analytical mechanics with an introduction to dynamical systems, Wiley, New York, 2000 ISBN 0471332070 Recommended literature J.L. MeriamL.G.Kraige, Engineering Mechanics: Statics, 5th SI ed, Wiley, New York, 2003 ISBN 0-471-26607-8. J.L. MeriamL.G.Kraige, Engineering Mechanics: Dynamics, 5th SI ed., Wiley, New York, 2003 ISBN 0-471-26606-X. W.E. Boyce, R.C.DiPrima, Elementary differential equations and boundary value problems, Wiley, New York .	
Assessment	Written	
Set-up	The course is given in lecture form, including application examples.	

IN1278LR	Introduction to Computer Programming	0
Responsible Instructor	Ir. C. Pronk	
Contact Hours / Week x/x/x/x	0/0/0/2	
Education Period	4	
Start Education	4	
Exam Period	4	
Course Language	Dutch English	
Course Contents	Introduction to programming with Java	
Study Goals	To obtain knowledge of, insight and skills in the basics of the computer language Java. To be able to write small programs in the programming language Java using modern tools for program editing and compiling.	
Education Method	Lecture.	
Literature and Study Materials	To be announced.	
Assessment	A multiple choice test wil be conducted near the end of the course.	
Remarks	See IN1278PR	

IN1278PR	Introduction to Computer Programming (Lab)	3
Responsible Instructor	Ir. C. Pronk	
Contact Hours / Week x/x/x/x	0/0/0/4: 7 weken 1 dagdeel	
Education Period	4	
Start Education	4	
Exam Period	4	
Course Language	Dutch English	
Required for	This course is a prerequisite for ae2-002.	
Course Contents	See IN1278LR	
Study Goals	To practise the things you learnt during the lecture (IN1278LR).	
Education Method	Lab	
Literature and Study Materials	Will be published on Blackboard.	
Assessment	7 exercises to be done + test	
Remarks	The practical will take 7 half days in the fourth period.	

WI1152th	Analysis for B.Sc. part 1	3
Responsible Instructor	Drs. N. Tholen	
Contact Hours / Week x/x/x/x	4/0/0/0	
Education Period	1	
Start Education	1	
Exam Period	1 2	
Course Language	Dutch	
Course Contents	Functions (domain and range, injectivity, inverse and hyperbolic functions) and models (descriptions, formulæ, graphs, tables, mathematical induction). Limits (common factors, principal terms, root trick, squeeze theorem) and continuity (existence of extrema, intermediate-value theorem). Differential calculus (notions, chain rule, implicit differentiation, mean-value theorem, approximation, optimization, l'Hospital's rule, asymptotic behaviour, linearization). Antiderivatives and integration (notions, Riemann sums, principal theorem of calculus, integration by parts, substitution rule, working with tables and computer algebra systems, improper integration, convergence criteria).	
Study Goals	Raising knowledge of concepts and understanding of rôle and function of mathematical analysis in engineering practice (modelling and computation), fostering ability to use mathematical and computer tools in doing calculations, preparing for advanced lectures.	

WI1153th	Analysis for B.Sc. part 2	3
Responsible Instructor	Drs. N. Tholen	
Contact Hours / Week x/x/x/x	0/4/0/0	
Education Period	2	
Start Education	2	
Exam Period	2 3	
Course Language	Dutch	
Course Contents	Sequences and series (limits and sums, connection with functions and integrals, absolute and conditional convergence, criteria, power series, radius and region of convergence, Taylor expansions, representation of functions by power series, applications). Complex numbers (rectangular notation, the complex plane, polar form, complex conjugation, power and exponential functions, complex roots, equations). Differential equations (modelling, direction fields, exponential behaviour, the separable and linear first-order cases, the second-order linear, constant-coefficient case, initial- and boundary-value problems).	

WI1154th	Analysis for B.Sc. part 3	3
Responsible Instructor	Drs. N. Tholen	
Contact Hours / Week x/x/x/x	0/0/4/0	
Education Period	3	
Start Education	3	
Exam Period	3 4	
Course Language	Dutch	
Course Contents	Vector functions (coordinate systems, parametrization of curves, curve length). Functions of several variables (examples, formulæ, graphs, contour plots, limits and continuity, partial and directional derivatives, linearization, differentiability, gradients, optimization). Multiple integration (notions, Riemann sums, iterated integrals, substitutions, applications).	

WI2256th	Linear Algebra and Differential Equations for TH-engineers	6
Responsible Instructor	Ir. P.C.W. van Beek	
Contact Hours / Week x/x/x/x	4/4/0/0	
Education Period	1 2	
Start Education	1	
Exam Period	1 2 3	
Course Language	Dutch	
Parts	Part 1: 4/0/0/0 Part 2: 0/4/0/0	
Course Contents	Part 1: systems of linear algebraic equations, vector equations,introduction to linear transformations, linear (in)dependence, null and column space, matrix algebra, matrix inversion, determinants, eigenvalue problems, (orthogonal) diagonalisation; Part 2: first and higher order linear differential equations, systems of first order linear and non-linear differential equations, fase plane, partial differential equations and Fourier series.	
Study Goals	getting acquainted with a number of mathematical techniques and notions with the aim to apply them to various technical-physical problems<>	
Education Method	Colstruction	
Literature and Study Materials	Part 1: D.C. Lay, Linear Algebra and its Applications; Part 2: Boyce and Diprima,Elementary differential equations and boundary value problems	
Prerequisites	For students with the equivalent of the Dutch TH-engeneer diploma	
Assessment	Closed book exam	
Permitted Materials during Tests	Table with standard integrals and table with Laplace transforms for part 2	

WM0203LR	Oral Presentation	0
Module Manager	Drs. P.C. Post	
Contact Hours / Week x/x/x/x	Part of ae3-001	
Education Period	4	
Start Education	4	
Exam Period	none	
Course Language	English	
Course Contents	During the Oral Presentations course, attention is focused on each student's individual skills, as well as on presentations with a several speakers. Subjects for the presentations are expected to stem from the design assignment (AE3-001). The course will deal with all aspects of presenting: 1. Introduction: presenting yourself, preparation, overcoming stagefright, preparing and using (technical) visual aids. 2. Delivery and evaluation of speeches: goal and effect of presentations, structure, body language, voice. 3. Persuasion, enthusiasm, audience involvement and answering questions	
Study Goals	The aim of this course is to increase the student's presentation skills to a level that is expected in the world of engineering. Emphasis lies on acquiring the general skills and insights that aerospace engineers need in different professional situations.	
Education Method	The Oral Presentation sessions are embedded in the Design Synthesis Exercise. Four two-hour classes will be used to introduce presenting and let every student practise a short presentation which will be evaluated by the tutor and by fellow students. All presentations are recorded on DVD, to allow students to also evaluate their own achievements. All students will take part in the Midterm Review and the Final Review. The tutors will be present during both presentations. The MTR is recorded and evaluated in a separte session, the FR is judged for grading.	
Literature and Study Materials	Buy and read the book: "Presentation Techniques" by Bob van der Laaken and Manon van der Laaken, Bussum: Coutinho publishers, 2007	
Assessment	The marks will be based on 1. The individual contribution to the Final Review 2. The group achievement in the (presentation of) the Final Review 3. The contribution to earlier sessions and presentations	

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