UNIVERSITY OF WASHINGTON

CREATING AND CHANGING UNDERGRADUATE ACADEMIC PROGRAMS

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College/Campus CoE/Seattle	**Department/Unit** Aeronautics & Astronautics	**Date** 1/11/2011

New Programs

- ☐ Leading to a Bachelor of Please see below in _____ degree.
- ☐ Leading to a Bachelor of _____ degree with a major in _____.
- ☐ Leading to a _____ Option within the existing major in _____.
- ☐ Leading to a minor in _____

Changes to Existing Programs

- ☐ New Admission Requirements for the Major in _____ within the Bachelor of _____.
- ☐ Revised Admission Requirements for the Major in _____ within the Bachelor of _____.
- ☐ Revised Program Requirements for the Major in _____ within the Bachelor of _____.
- ☐ Revised Requirements for the Option in _____ within the major in _____.
- ☐ Revised Requirements for the Minor in _____.

Other Changes

- ☐ Change name of program from _____ to _____.
- ☐ New or Revised Continuation Policy for _____.
- ☐ Eliminate program in _____.

Proposed Effective Date: **Quarter:** ■ Autumn ☐ Winter ☐ Spring ☐ Summer **Year: 20** 11

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EXPLANATION OF AND RATIONALE FOR PROPOSED CHANGE

For new program, please include any relevant supporting documentation such as student learning outcomes, projected enrollments, letters of support and departmental handouts. (*Use additional pages if necessary*).

We are creating a new undergraduate program at Abu Dhabi, United Arab Emirates that parallels our undergraduate A&A program here. We propose the degree title "UW International Bachelor of Aerospace Engineering". Attached, please find a document showing the Aerospace Engineering Curriculum that shows a side-by-side comparison of our program with the proposed new curriculum at the UAEU designed to parallel our program, the term layout of the courses, and the course descriptions. Also attached, please find our answers to information requested.

OTHER DEPARTMENTS AFFECTED

List all departments/units/ or co-accredited programs affected by your new program or changes to your existing program and acquire the signature of the chair/director of each department/unit listed. Attach additional page(s) if necessary. *See online instructions.

Department/Unit:	Chair/Program Director:	Date:
Department/Unit:	Chair/Program Director	Date:

CATALOG COPY

Catalog Copy as currently written. Include only sections/paragraphs that would be changed if your request is approved. Please cross out or otherwise highlight any deletions.

None exists as this is for a new program.

PROPOSED CATALOG COPY

Reflecting requested changes (Include exact wording as you wish it to be shown in the printed catalog. Please underline or otherwise highlight any additions. If needed, attach a separate, expanded version of the changes that might appear in department publications). **Please note:** all copy will be edited to reflect uniform style in the General Catalog.

Please see the course descriptions in the attached document, "Aerospace Engineering Curriculum"

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APPROVALS

Chair/Program Director:	Date: 1/11/11
College/School/Campus Curriculum Committee:	Date:
Dean/Vice Chancellor:	Date:
Faculty Council on Academic Standards/ General Faculty Organization/Faculty Assembly Chair:	Date:

POST TRI-CAMPUS APPROVAL (when needed)

Faculty Council on Academic Standards/ General Faculty Organization/Faculty Assembly Chair:	Date:

Information that is to be included in petitions to the Faculty Council on Academic Standards requesting waiver of the 45-credit residency requirement contained in Volume 4, Part III, Chapter 14, Section 1, paragraph B of the University Handbook:

UW 1503 containing the following information:

- Justification for requesting the waiver including the anticipated population to be served by the program, access issues to be addressed, and relationship of the new program to existing degree programs and the mission of the academic unit

  The proposed new program will involve the granting of UW bachelor's degrees at the United Arab Emirates University (UAEU) in Al Ain, United Arab Emirates (UAE). This program will be conducted in close collaboration with the UW Department of Aeronautics and Astronautics (A&A) in Seattle, who will oversee and assist the development of the new program.

  The program will be similar in scope to the existing Bachelor of Science in Aeronautics and Astronautics (BSAA) currently offered by the UW A&A Department. This is an upper class program, operating over the junior and senior years. It is anticipated that there will be approximately 30 students initially enrolled in the program each year; that number may increase to as many as 60 students.

  No access issues are anticipated as all courses, labs, and other academic functions will be conducted on-campus at the UAEU in Al Ain.

  The new degree program will be essentially identical to the existing UW BSAA degree in scope, quality, requirements, and content. The only significant deviation is that the new degree will not emphasis astronautics but will focus exclusively on aeronautics. Thus there will be very few space-based classes and no space design class, as is the case for the BSAA in Seattle.

- Admission requirements and admission processes to be used, including admission to UW and English language proficiency testing

  The admissions requirements will be essentially identical to students seeking admission to the UW BSAA program in Seattle. Students shall apply for admission to the program during their sophomore year of study at the UAEU. All UAEU students take the TOEFL as a condition for admission prior to their freshman year. Given that the proposed UW-degree program at the UAEU does not begin until the junior year, and that all instruction at the UAEU is in English, no significant language issues are anticipated. Nonetheless, applicants to the UW degree program shall be required to take the TOEFL prior to admission into the program in their junior year, and shall be expected to achieve similar scores as foreign applicants to the UW undergraduate program in Seattle.

- A description of the curriculum, including general education requirements, and graduation requirements

  Please see the attached proposed UAEU Aerospace Engineering curriculum (Appendix A); the corresponding UW-Seattle BSAA curriculum (Appendix B) follows the UAEU curriculum.

- Continuation policy

  Having similar academic requirements and a similar plan of study to the UW-Seattle BSAA program, the new Aerospace Engineering Program at the UAEU will have a similar continuation policy to the Seattle program. That policy is provided in Appendix C.

- Potential for admitted students attending classes on campus in Seattle, Tacoma, or Bothell

  None … the students involved will be entirely in residence at the UAEU in Al Ain, United Arab Emirates for the duration of their program.

- Methods of course delivery to be used and number of courses to be taught by UW faculty

  Courses will be delivered on-site at the UAUE Campus in Al Ain. All courses in the program will be taught by UW faculty. Courses will be primarily taught by UAEU faculty, all of whom involved with this program will be granted appropriate affiliate faculty appointments through the Department of Aeronautics and Astronautics in Seattle. UW Seattle-based A&A faculty will assist with the teaching of selected courses (1-2 per year) at the UAEU in Al Ain.

- Program faculty and methods of approval if not UW faculty

- Program goals and learning objectives

  The goals and learning objectives of the new program will be similar to those for the existing BSAA degree program in Seattle, specifically:

  Objective number one is to solve critical technical problems related to aerospace engineering.

  Objective number two is to devise innovative ways to develop and apply new technologies

  Objective number three is to contribute knowledge to and participate in the identification and solution of problems facing society.

  Objective number four is to engage in lifelong continuous learning and professional contribution.

- Program outcome measures

  Multiple means will be employed to determine how well students have accomplished what they are expected to know and be able to do by the time they graduate from the program. The evaluation instruments will include examinations and projects, student surveys and interviews, and oversight evaluations performed by the UW A&A Faculty in Seattle. The desired specific outcomes include:

  a) An ability to apply knowledge of mathematics, science and aerospace engineering (fluids, structures, controls, propulsion, flight mechanics, orbital mechanics, orbital mechanics, and energetics)

  b) An ability to design and conduct experiments, as well as to analyze and interpret data

  c) An ability to design a system, component or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability and sustainability

  d) An ability to function on multi-disciplinary teams

  e) An ability to identify, formulate and solve engineering problems

  f) An understanding of professional and ethical responsibilities

  g) An ability to communicate effectively

  h) The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental and societal context

  i) A recognition of the need for, and an ability to engage in life-long learning

  j) Knowledge of contemporary issues

  k) An ability to use the techniques, skills and modern engineering tools necessary for engineering practice

- Program quality oversight process

  The new program will be subject to extensive oversight from the UW A&A Department in Seattle. An A&A faculty member in Seattle will serve as Director of this program, with assistance from an administrator dedicated to the support of the UAEU/UW collaboration, as well as an undergraduate academic advisor who shall be hired specifically to support this program. All of these support positions will be in Seattle. In addition, the UW shall hire a full-time program director that shall be in residence at the UAEU.

  All UAEU faculty involved with this program shall first spend one or more quarters in residence in the UW A&A Department in Seattle. This will assure that they are intimately familiar with the A&A program in Seattle, upon which the new program at the UAEU is based, and will also ensure that all individuals are capable instructors and fully qualified to teach aerospace engineering courses at the UAEU. All satisfactory visiting UAEU faculty members will be granted affiliate appointments as members of the A&A Faculty.

Program quality oversight (continued)

In addition to the above, UW-Seattle faculty will regularly visit the UAEU during each academic year to directly observe and monitor the status and quality of the new undergraduate program at the UAEU. These will include 1-2 quarter-long visits by UW-Seattle faculty each academic year of the program.

Finally, an expressed goal of the program is to eventually achieve ABET accreditation for the UAEU aerospace engineering program (this accreditation will not be sought for the UW degree program at the UAEU). Working the necessary steps to gain ABET accreditation will further ensure the quality of the new aerospace undergraduate degree at the UAEU.

- Method of providing library and advising services to students

  The UAEU has a well-equipped academic library fully satisfactory to support the students in the proposed program. On-site academic advising will be provided by a dedicated undergraduate advisor at the UAEU, as well as the UW-trained UAEU faculty.

Appendix A

Proposed UAEU Aerospace Engineering Curriculum

(equivalent UW-Seattle courses in right column)

Mathematics

UAEU	SCH	UW	QCH
MATH1110 Calculus I	3	MATH124 Calculus with Analytic Geometry I	5
MATH1120 Calculus II	3	MATH125 Calculus with Analytic Geometry II	5
MATH2210 Differential Equations	3	MATH 126 Calculus with Analytic Geometry III	5
MATH2220 Linear Algebra	3	MATH 307 Intro. Differential Equation.	3
MECH 384 Mech. Eng. Analysis	3	MATH 308 Matrix Algebra	3
MATH xxx Multivariable Calculus	3	MATH 324 Adv. Multivariable Calculus	3
Total	18		24

Science

UAEU	SCH	UW	QCH
PHYS1110 Phys & Eng. Appl. 1	4	Phys 121 Mechanics	4
PHYS 1120 Phys & Eng. Appl. 2	4	Phys 122 Electromagnetism	5
CHEM 1701 Chem & Eng. Appl.	4	Phys 123 Waves	5
Tech Elective	3	CHEM 124 General Chemistry	5
Total	15		19

Written & Oral Communication

UAEU	SCH	UW (8-12Cr)	QCH
ESP107 English for Engineering	3	ENGL111 Composition	5
ESP English Communication Skills	3	ENGL121 Composition	5
		ENGL131 Exposition	5
		HCDE231 Technical writing	3
		TC333 Adv. Tech. Writing	4
Total	6		8-12

General Education

UAEU	SCH	UW	QCH
ISLM 1103 Islamic Thoughts	3		
SOC 11153 Emirates Society	3		
Learning and Thinking Skills	3		
Humanities & Fine Art	3		
Global Experience	3		
Total	15		24

College Requirement/Fundamentals

UAEU	SCH	UW (8-12Cr)	QCH
GENG 250 Freshman Lab	2		
STAT 220 Eng. Statistics	2		
GENG 200 Intro to Programming	2	CSE 142 Computer Programming	4
GENG 215 Design and Ethics	2		
GENG 220 Thermodynamics	3	CHEM 260 Thermodynamics	4
MECH 390 Engineering Materials	3		
GENG 315 Engineering Practice & Entrepreneurship	3		
Total	17		8

Mechanical Fundamentals

UAEU	SCH	UW	QCH
GENG 240 Statics	3	AA210 Engineering Statics	4
GENG 305 Mechanics of Materials	3	CEE 220 Mechanics of Materials	4
MECH 310 Dynamics & Vibration	3	ME 230 Kinematics & Dynamics	4
MECH340 Fluid Mechanics	3	AA402 Fluid Mechanics	3
MECH 348 Fluid Mechanics Lab	1		
Total	13		24

Aerospace Courses

UAEU (suggested)	SCH	UW	QCH
ASE 301 Aerodynamics I	3	AA301 Compressible Aerodynamics	4
ASE 302 Aerodynamics II	3	AA302 Incompressible Aerodynamics	4
		AA311 Atmospheric Flight Mechanics	4
ASE 310 Orbital and Space Flight Mechanics*	3	AA310 Orbital and Space Flight Mechanics	4
ASE 312 Aerospace Structures I	3	AA312 Structural Vibration	4
ASE 331 Aerospace Structure II	3	AA 331 Aerospace Structure I	4
		AA 332 Aerospace Structure II	4
ASE 321 Aerospace Lab I	1	AA 320 Aerospace Instrumentation	3
ASE 322 Aerospace Lab II	1	AA 321 Aerospace Lab I	3
		AA 322 Aerospace Lab 2	3
ASE 360 Propulsion	3	AA 360 Propulsion	4
		AA461 Advanced Propulsion	4
ASE 432 Composite Materials	3	AA 432 Composite Materials	4
ASE 447 Control for Aerospace Sys. I	3	AA 447 Control in Aerospace Systems	4
ASE 448 Control II (elective)		AA 448 Control Systems Sensors & Actuators	4
		AA 449 Design of Automatic Control System	4
MECH 411 Heat Transfer	3	AA 419 Aerospace Heat Transfer	4
ASE 440 Flight Mechanics	3	AA 440 Flight Mechanics I	4
		AA 441 Flight Test Mechanics	4
ASE 450 Space Altitude Dynamics*	3		
ASE 410 Aerospace Maintenance	3		
ASE 585 Senior Design I	3	AA 410 Aircraft Design I	4
ASE 590 Senior Design II	3	AA 411 Aircraft Design II	4
Total	44		81

*Astronautical

9 CH (3 courses) as technical electives

1st Term Year 1

Course Number	Course Title	Cr. Hr	Pre/Co Requisite	UW
GENG 215	Intro. to design and ethics	2	ENGU 1303, INTU 1302	
GENG 200	Intro. To programming	2	ENGU 1303, INTU 1302	
MATH 1110	Calculus I for engineers	3	ENGU 1303, MATU 1332	MATH124 MATH 125
PHYS 1110	Phys &eng. appl. I	4	ENGU 1303, MATU 1332	PHY 121
CHEM 1701	Chem. & eng. Appl.	4	ENGU 1303, MATU 1332	CHEM 124
ESPU 107	English for engineering	3	ENGU 1303	ENGL 111 ENGL 121
		18		

2nd Term Year 1

Course Number	Course Title	Cr. Hr.	Pre/Co requisite	UW
GENG 250	Freshman Lab	2	STAT 220 (co)	
STAT 220	Engineering statistics	2	MATH 1110 ESPU 107	
MATH 1120	Calculus II for engineers	3	MATH 1110	MATH 126
PHYS 1120	Phys &eng. appl. II	4	PHYS 1110	PHY 122
GENG 220	Eng. thermodynamics	3	PHYS 1110	CHEM 260
MECH 390	Eng. materials	3	CHEM 1701	
		17		

1st Term Year 2

Course No.	Course Title	Cr. Hr.	Pre-requisite	UW
MATH 2210	Diff. equations. & eng. Applications	3	MATH 1120	MATH 307
GENG 315	Eng. practice & entrepreneurship	3	MATH 1110	
MATH 2220	L. Algebra & Eng. Applications	3	MATH 1120	MATH 308
MECH 315	Geometric modeling	2	GENG 215(co)	
GENG 240	Statics	3	PHYS 1110	AA 210
GENG 305	Mechanics of materials	3	GENG 240	CEE 220
		17		

2nd Term Year 2

Course No.	Course Title	Cr. Hr.	Pre-requisite	UW
MECH 384	Mechanical Engineering Analysis	3	MATH 2210	
MECH 310	Dynamics and vibration	3	GENG 240 MATH 2220	ME 230
ASE 301	Aerodynamics I	3		AA 301 AA 302
MECH 340	Fluid mechanics	3	GENG 240	AA 402
MECH 348	Fluid mechanics lab	1	MECH 340 (co)	
MATH XXX	Multivariable Calculus	3		MATH 324
		16		

1 st Term Year 3

Course No.	Course Title	Cr. Hr.	Pre-requisite	UW
ASE 302	Aerodynamics II	3	ASE 301	AA 302 AA 311
ASE 310	Orbital & Space Mechanics	3	MECH 310	AA310
ASE 360	Propulsion	3	MECH 340	AA360 AA461
ASE321	Aerospace Lab I	1		AA 320 AA321
ASE312	Aerospace Structure I	3	GENG 305	AA312 AA331
ASE 447	Control I	3	MECH 310	AA447 AA448
		16		

2nd Term Year 3

Course No.	Course Title	Cr. Hr.	Pre-requisite	UW
ASE322	Aerospace Lab II	1	ASE 321	AA321 AA322
ASE 432	Composite Materials	3	GENG 305	AA432
ISLAM	Islamic Thoughts	3		
MECH 411	Heat Transfer	3	GENG220	AA419
ASE 331	Aerospace Structure II	3	ASE 312	AA331 AA332
ASE xxx	Technical Elective 1	3		
		16		

1st Term 4th Year

Course No.	Course Title	Cr. Hr.	Pre-requisite	UW
ASE 440	Flight Mechanics	3	ASE 447	AA440 AA441
ASE 450	Space Altitude Dynamics	3	ASE 310	
ASE 410	Aerospace Maintenance	2		
ASE 585	Senior Design I	3	Co- ASE 440	AA 401
	General Education 3	3		
ASE xxx	Technical Elective 2	3		
		17		

2nd Term 4th Year

Course No.	Course Title	Cr. Hr.	Pre-requisite	UW
	General Education 4	3		
SOC	Emirates Society	3		
ASE xxx	Technical Elective 3	3		
ASE 590	Senior Design II	3		AA 402
	General Education 5	3		
		15		

Please note that students at UAEU are required to take a one semester long industrial training.

Course Descriptions

Mathematics

MATH 1110 Calculus I for Engineers (3CH)

Differential Calculus of functions of one variable Functions of one variable. Techniques of Differentiation. Derivatives of Trigonometric, Exponential & Logarithmic Functions - Chain Rule - Implicit Differentiation. Maximum & Minimum Values. Increasing, Decreasing & Concave Functions. Inverse Trigonometric Functions. Hyperbolic Functions. Some Engineering Applications.

Integral Calculus of functions of one variable Definite and Indefinite Integrals. Techniques of Integration: Integration by Substitution - Integration by Trigonometric Substitutions - Integration by Parts - Integration by Partial Fractions. Applications of Definite Integrals in Geometry. Some Engineering Applications. Functions of Two variables

Students are obliged to attend an extra 1 hr of Math problem solving managed by CRU. *Prerequisite: MATU 1332, ENGU 1303*

MATH 1120 Calculus II for Engineers (3CH)

Differential Calculus of functions of several variables. Vector Valued Functions - Functions of Several Variables- Partial Derivatives -Chain Rule - Gradient and Directional Derivatives – Extrema of Functions of Several Variables. Quadratic Surfaces. Vector Fields and Line Integrals - Double Integrals in Cartesian and Polar Coordinates - Triple Integrals in Cartesian, Cylindrical and Spherical Coordinates.

Students are obliged to attend an extra 1 hr of Math problem solving managed by CRU. Prerequisite: MATH 1110

MATH 2220 Linear Algebra and Engineering Applications (3CH)

Linear Algebra Matrices- Determinants- System of Linear Equations- Eigenvalues and Eigenvectors- Diagonalization. Some Engineering Applications. Complex Analysis Complex Numbers - Complex Variables -Differentiation of Complex Functions - Complex Integration - Conformal Mappings. Prerequisite: MATH 1120

MATH 2210 Differential Equations and Engineering Applications (3CH)

Ordinary Differential Equations First Order Differential Equations: Separable- Homogenous -Linear- Bernoulli - Exact- Integrating Factors. Second Order Linear Differential Equations: Homogenous Equations with Constant Coefficients - Undetermined Coefficients Method - Variation of Parameters Method - Euler's Equation - Non Homogenous Equations - Higher Order Linear Equations - Systems of Differential Equations. Laplace Transforms Basic Properties - Solving Initial Value Problems Using Laplace- Solving Integral Equations - Solving Systems of Differential Equations. Some Engineering Applications. Prerequisite: MATH 1120

MECH 384 Mechanical Engineering Analysis (3CH)

This course aims to provide students with a background in modern numerical methods and programming techniques. Topics includes; errors, solution of nonlinear algebraic and transcendental equations, numerical integration and differentiation, numerical solution of O.D.E. Interpolation, curve fitting, numerical methods for solving systems of nonlinear equations, an introduction to optimization, and some mechanical engineering applications.

MATHXXX Multivariable Calculus (3CH)

Topics include double and triple integrals, the chain rule, vector fields, line and surface integrals. Culminates in the theorems of Green and Stokes, along with the Divergence Theorem.

Science

PHYS 1110 Physics and Engineering Applications I (4CH)

The course aims at developing a clear understanding of the basic physics concepts in mechanics for the Engineering students. It includes: units and dimensions of physical quantities, vectors, kinematics, Newton's laws of motion, work and energy, linear momentum and collision, angular momentum, rotational motion about an axis and its engineering applications. The course intends to develop the students' learning skills (e.g. problem solving) and creative thought needed to meet the challenges in the modern technology by using Laptop as educational tool. The course includes laboratory sessions with emphasis on engineering application. Prerequisite: MATU 1332, ENGU 1303

PHYS 1120 Physics and Engineering Applications II (4CH)

The course aims at developing a clear understanding of the basic physics concepts in electricity and magnetism. Topics covered include: Coulomb's Law, the electrostatic field, the electrostatic potential, capacitance and dielectrics, magnetic field and magnetic forces, sources of magnetic fields, electromagnetic induction, AC circuits, engineering applications in electricity and magnetism. The course seeks to develop students' learning skills (e.g. problem solving and report writing) and creative thought needed to meet the challenges in the modern technology by using Laptop as educational tool. The course includes laboratory sessions with emphasis on engineering application. Prerequisite: PHYS 1110

CHM 1701 Chemistry and Engineering Applications (4CH)

Measurements; chemical formulas and equations; stoichiometry; reactions in aqueous solutions; physical behavior of gases; electronic structure of the atom: the periodic table and the periodic properties; chemical bonding, molecular structure, thermo-chemistry, liquids, solutions, and solids; Engineering applications covering the previous subjects.

Prerequisite: MATU 1332, ENGU 1303

College Requirement

GENG 215 Introduction to Engineering Design and Ethics (2CH)

This course introduces students to engineering ethics, as set of moral principles that relate to engineering projects and designs. The course explores creative ways of reconciling moral claims. It outlines the responsibilities of engineers towards public safety and the environment within economic constraints and governing laws. A systematic engineering design process is introduced. Each design stage explores relevant methods and their ethical implications. The course critically examines litigations that involve the engineering profession in relation to product liability.

STAT 220 Engineering Statistics (2CH)

Concepts of probability theory and statistical applications in engineering systems. The course covers engineering applications of probability theory, sampling theory, random samples, random variables, probability models, basic statistics, confidence intervals, hypothesis testing, inference, simple linear regression. *Prerequisite: MATH 1110*

GENG 200 Introduction to Programming (2CH)

Excel simple and nested conditional statements, trend line graphing and equation solving, fundamentals of programming, logic, algorithms, decision making, programming concepts, variable types, loops, arrays, visual basic programming environment, VB procedures, VB functions, VB macros, debugging of programs, exchanging data between excel and VB functions and macros, writing user defined functions, invocation of the VB functions, macros and procedures from the Excel environment. *Prerequisite: , ENGU 1303, INTU 1302*

GENG 250 Freshman Lab (2CH)

This course is an introduction to techniques for engineering measurement, data acquisition, processing, and analysis. Laboratory exercises are drawn from various engineering disciplines. *The delivery pattern is based on a series of mini lectures on laboratory safety, laboratory practice and hardware, experimental data processing, report writing, presentations and a project based hands-on approach to laboratory experimentation. Co-requisite : STAT 220*

GENG 220 Engineering Thermodynamics (3CH)

Thermo-physical properties of pure substances and gases. 1st law of thermodynamics, conservation of energy, and closed and open systems. Limitations and efficiencies of energy conversion processes. Introduction to the 2nd law of thermodynamics and entropy. Applications in Engineering. *Prerequisite: PHYS 1110*

MECH 390 Engineering Materials (3CH)

This course aims at studying basic concepts and fundamentals of material science and engineering. Topics covered include atomic structure, arrangements, unit cells, types of engineering materials, testing, mechanical and electrical properties, processing, and behavior in service, corrosion, deformation, material and process selection. *Prerequisite: CHEM 1701*

GENG 315 Engineering Practice and Entrepreneurship (3CH)

Introduction to the basic concepts and principles of engineering practice and entrepreneurship. Familiarization of the different cost components, cost estimation techniques, cash flow analysis, and measures of project performance. Introduction to risk analysis. Comparing alternatives and replacement analysis. Application of engineering practice and entrepreneurship to engineering design and projects. *Prerequisite: MATH 1110*

ME-Courses

GENG 240 Statics (3CH)

Scalar and vector quantities, Two dimensional force systems: forces, moments, Couples and resultants, free-body diagrams, equilibrium conditions, three-dimensional force systems, analysis of structures: method of joints, method of sections, distributed forces: introduction to shear forces and bending moments in beams, Center of mass and centroid, Properties of areas, and friction.

MECH 315 Geometric Modeling (2 CH)

Topics covered will include Freehand sketching, Orthographic and Isometric Projections, Sectional Views, Dimensioning. Introduction to Geometric modeling and representation, Solid Modeling, Parametric and Feature-Based Modeling. Students will use a modern mechanical engineering package (Pro/E) throughout to apply the concepts learnt during this course. *Pre-requisite: Introduction to Design and Ethics.*

MECH 340 Fluid Mechanics (3 CH)
This course aims at providing students with essential concepts of fluid mechanics. Topics covered include: Fluid properties, similitude, fluid statics, Bernoulli's equation, applications of mass, momentum & energy equations, viscous flow in pipes, flow over immersed bodies, introduction to turbomachinery. *Pre-requisite: GENG 240*

MECH 345 Fluid Mechanics Lab (1 CH)
This lab aims to provide students with in-depth understanding of theoretical phenomena studied in the fluid mechanics course. Students are required to use data acquisition system to acquire, analyze, and interpret results. Experiments include: Measurement of pressures, pressure loss in pipes, impact of jet, hydrostatic forces, viscosity, fluid flow rate, lift and drag, boundary layer; flow visualization, shock wave, velocity profiles in laminar and turbulent flows, performance of turbomachines. *Pre-requisite: MECH340 (Fluid Mechanics)*

GENG 305 Mechanics of Materials (3 CH)
This course aims at introducing basic concepts and applications of elastic stress analysis. Topics covered include stress and strain; material behavior; Hooke's law; axial loading; safety factors; properties of area; shear force and bending moment diagrams; bending stresses and defections; shear stresses in beams; torsion of circular members; combined stresses; Mohr's circle; buckling of columns; and engineering applications. *Pre-requisite: GENG 240*

MECH 310 Dynamics and Vibrations (3 CH)
This course intends at providing fundamentals of particles and rigid body dynamics. The course starts with dynamics of particles in plane, rectilinear and curvilinear motion, work done, Kinetic energy, potential energy, particle impulse and momentum. It also includes vibration and time response, kinematics of rigid bodies, angular and absolute motion, dynamics of steady and variable mass flow, plane kinematics and kinetics of rigid bodies. *Pre-requisite: PHYS 1110, MATH 1110 Prerequisite: PHYS 1120, GENG 250*

MECH 411 Heat Transfer (3 CH)
This course aims at providing students with essential concepts of Heat Transfer. Topics covered include: Steady and transient heat conduction, forced and natural convection, internal and external flows, principles of engineering thermal radiation, heat exchanger, boiling and condensation. *Pre-requisite: GENG 220*

Aerospace Courses

ASE 301 Aerodynamics I (3CH)
Aerodynamics as applied to the problems of performance of flight vehicles in the atmosphere. Kinematics and dynamics of flow fields; Incompressible flow about bodies. Thin airfoil theory; finite wing theory. Compressible fluids; one-dimensional compressible flow; two-dimensional supersonic flow.

ASE 302 Aerodynamics II (3CH)
Applied Aerodynamics, aircraft flight envelope, minimum and maximum speeds, climb and glide performance. Range and endurance, take-off and landing performance, using both jet and propeller power plants. Longitudinal and dynamic stability and control, wing downwash, stabilizer and elevator effectiveness, power effects. Lateral and directional stability and control.

ASE 310 Orbital and Space Flight Mechanics (2CH)
Newtons law of gravitation. Two-body problem, central force motion, Keplers laws. Trajectories and conic sections. Position and velocity as functions of time. Orbit determination and coordinate transformations. Rocket dynamics, orbital maneuvers, Hohmann transfer. Interplanetary trajectories, patched conics. Planetary escape and capture. Gravity assist maneuvers.

ASE 312 Aerospace Structures I (3CH)
Vibration theory. Characteristics of single and multidegree-of-freedom linear systems with forced inputs. Approximate methods for determining principal frequencies and mode shapes. Application to simple aeroelastic problems. Review of concepts of stress, deformation, strain, displacement and equations of elasticity. Applications to aerospace structural elements including general bending and torsion of rods and beams, and open and closed thin-walled structures and box beams.

ASE 331 Aerospace Structure II(3CH)

Analysis and design of aerospace structures. Bending of plates and shells. Buckling analysis. Energy principles and minimum potential energy. Introduction to the finite element method. Airworthiness and airframe loads. Strength and damage characteristics of ductile, brittle and composite materials. Elements of fracture mechanics and fatigue.

ASE 321 Aerospace Lab I (1CH)
Hands-on laboratory experience in aerospace instrumentation. Students build sensors, power supplies, and circuits. Application of signal conditioning to wind tunnel data. Digital systems, A/D conversion, D/A conversion, and actuator control. Introduction to instrumentation requirements for space vehicles. Theory, calibration, and use of instruments, measurement techniques, analysis of data, report writing.

ASE 322 Aerospace Lab II (1CH)
The design and conduct of experimental inquiry in the field of aeronautics and astronautics. Laboratory experiments on subsonic aerodynamics, supersonic flow, structures, propulsion, vibrations, material properties, and other topics. Theory, calibration, and use of instruments, measurement techniques, analysis of data, report writing.

ASE 360 Propulsion (3CH)
Study of the aero- and thermodynamics of jet and rocket engines. Air-breathing engines as propulsion systems. Turbojets, turbofans, turboprops, ramjets. Aerodynamics of gas-turbine engine components. Rocket vehicle performance. Introduction to space propulsion.Physical characteristics and components of rockets. Nozzle gasdynamics and non-ideal flow effects. Solid and liquid propulsion systems, components, and design.

ASE 432 Composite Materials (3CH)
Introduction to analysis and design of aerospace structures utilizing filamentary composite materials. Basic elastic properties and constitutive relations of composite laminates. Failure criteria, buckling analysis, durability, and damage tolerance of composite structures. Aerospace structure design philosophy and practices.

ASE 447 Control for Aerospace Sys. I (3CH)
Overview of feedback control. Linearization of nonlinear models. Model properties: stability, controllability, observability. Dynamic response: time and frequency domain techniques. Frequency response design techniques. Design of aerospace control systems via case studies. Design problems for aerospace vehicles, systems with unstable dynamics, lightly damped modes, nonminimum phase, nonlinear dynamics.

ASE 440 Flight Mechanics (3CH)
Calculation of aerodynamic characteristics of aircraft and components including stability derivatives. Relation to wind tunnel and flight data. Vehicle equations of motion within the atmosphere, characteristics of propulsion systems and components including propellers. Prediction of performance, stability and control characteristics for a specific aircraft. Determination in flight of performance, stability, and control characteristics of aircraft; and comparison with predicted and wind tunnel results.

ASE 450 Space Altitude Dynamics (3CH)
Motion of spacecraft about center of gravity. Rigid body dynamics and rotational kinematics. Mission pointing requirements and design of the attitude determination and control system. Prerequisite: ASE 310

ASE 410 Aerospace Maintenance (3CH)
Aviation maintenance regulations, records, and document; servicing procedures and ground operation, aviation material. Hydraulic avionic, ignition, environmental, and fuel systems, engine overhaul. Installation and repair; inspection testing; weight and balance computation. Components and systems reliability and maintainability computations. Hazard rates and failure distribution behavior. Reliability testing, design for reliability, design for maintainability.

ASE 585 Senior Design I (3CH)
Conceptual design of a modern airplane to satisfy a given set of requirements. Estimation of size, selection of configuration, weight and balance, and performance. Satisfaction of stability, control, and handling qualities requirements.

ASE 590 Senior Design II (3CH)
Preliminary design of a modern airplane to satisfy a given set of requirements. Estimation of size, selection of configuration, weight and balance, and performance. Satisfaction of stability, control, and handling qualities requirements.

Technical Electives: Students must choose up to 3 courses (9CH).

Aerodynamics Basket

ASE 511: Intermediate Gas Dynamics: 3CH (3+0)
Fundamentals of compressible fluid flow (gas dynamics) in relation to effects of area change, friction and heat interaction, combustion waves (deflagration, explosion, and detonation waves), normal and oblique shock waves and their effects on flow properties (extended diffusers and supersonic airfoils). Applications to flow through pipelines, subsonic, sonic, and supersonic flights, turbo machinery and combustion. Linearized flow; method of characteristics, conical flow. Experimental methods in gas dynamics.
Prerequisites: ASE 301

ASE 513: Aerospace Propulsion II: 3CH (3+0)
Engine inlet at sub- and supersonic speed. Combustion chamber. Exhaust system. Systems: air system, oil system, accessories, controller, engine start. Introduction to rockets and performance of rocket vehicle engines. Prerequisites: ASE 301.

MECH 514 Heat Engines: 3CH (3+0)
This course aims to provide students with in-depth understanding of engines, fuels and exhaust emissions. Topics include introduction and classifications of engines, fuel air and actual cycles, thermo-chemistry of combustion processes, flame types, chemical kinetics, normal and abnormal combustion in spark ignition and compression ignition engines, air pollution from combustion systems, engine performance and testing, non-conventional engines.
Prerequisites: GENG 220

ASE 515 Special Topics in Aerodynamics: 3CH (3+0)
Course designed to fulfill special interest in the field of aerodynamics.

Astronautical Engineering Basket

ASE 521: Rocket Propulsion 3CH (3+0)
Preliminary design considerations of a rocket engine for a missile or satellite. "Exotic" rocket propulsion systems.
Prerequisite: ASE 301

ASE 522: Introduction to Spacecraft Design: **3CH (3+0)**
Introduction to space mission analysis and the principles of spacecraft design, space mission life cycle, mission constraints and objectives; cost estimation.
Prerequisite: ASE 450

ASE 526: Orbital Mechanics II: 3CH (3+0)
Orbital mechanics; perturbations and numerical integration. Global positioning system, launch performance and optimization.
Prerequisite: MECH 384

ASE 525: Selected Topics in Astronautical Engineering: 3CH (3+0)
Course designed to fulfill special interest in the field of astronautical engineering.

Structures and Materials Basket

ASE 552: Computer-Aided Control System Design: 3CH (3+0)
Computer-aided design and analysis of control systems for high-order linear systems. Stability and performance design criteria. Root locus, Introduction to state-space modeling methods, State-feedback control. Attitude determination and control. Application to aircrafts.

ASE 558: Finite Element Methods: 3CH (3+0)
Principles and applications of the finite element method. Matrix and vector operations, structure and organization of finite element computer program. Structural and nonstructural elements and applications.
Prerequisites: ASE 405

MTSE (611) Materials Characterization: 3CH (3+0)
Principles and applications of analytical techniques, imaging, diffraction and spectroscopy for materials characterization, microscopic analysis (Optical, TEM, SEM, and electron microprobe analysis). Spectroscopic characterization of materials utilizing UV, IR, NMR, Atomic Absorption). Liquid Chromatography, including GC, GCMS, HPLC, GPC. Thermal characterization (DTA, DSC, TGA, and TMA). X-ray techniques, elemental and structural analysis.Prerequisites: ASE 315

MTSE (635) Properties and Processing of Composites:3CH (3+0)
Types of fibers, continuous and discontinuous fibers. Hybrid composites, mechanics and thermodynamics of interfaces; mechanical properties and fabrication of engineering composites. Intrinsic properties of matrix materials and fibers. Fiber reinforced composites, rule of mixture. Theory of lamination, sandwich and honeycomb structures. Prerequisites: ASE 420

ASE 555 Special Topics in Structures and Materials: 3CH (3+0)
Course designed to fulfill special interest in the field of structures and materials.

Systems Engineering Basket

ASE 541 Introduction Engineering Management: 3CH (3+0)
Analysis of complex hardware, software systems including quantitative methods to understand vague problem statements; focus on product/system functionality; generate measurable requirements; conceive and evaluate solutions, describe appropriate analytical, experimental, and economic evaluations; design optimization with a systems thinking including the entire product life cycle; risk management; test strategies and trade-off studies to verify that finished product/system satisfies the design intent functionality.

ASE 546 Project Management: 3CH (3+0)
Project definition, Project management phases (initiation, planning, execution, control, and closure) and their interactions. The role of the PM . WBS and resource allocation. Managing projects using information systems. Integration of project management and strategic management. purpose and preparation of portfolios.

ASE 542 Operations Research: 3CH (3+0)
Operations Research Overview. Models and Modeling. General Problem Formulation; Graphical Solution of 2-dimensional LPs; Simplex Method; Simplex Algorithm; Simplex Algorithm Software Programs; Duality; Sensitivity Analysis; Network Programming; Integer Programming; and Nonlinear Programming.

ASE 543 Quality Engineering:3CH (3+0)
Quality definition and history; principles of product and service quality evaluation and control; basic tools (pareto charts, fishbone diagrams, flowcharts); Control Charts for Measurement and Attribute data; Capability Studies; Continuous Improvement, ISO 9000:2008; Requirements, quality functional deployment; Six Sigma and Taguchi Methodology; Achieving Competitive Excellence (ACE); Relentless root cause analysis. Acceptance sampling plans, control chart methods for attributes and variables.

ASE 544 Safety Engineering: 3CH (3+0)
Organization, administration and management of safety. Safety engineering principles including facility and work status, material handling, work place exposures and protection, and production operations. Human and ergonomic factors. Hazardous materials and waste management, handling, storage, transportation and emergency response. Overview of occupational safety and health in business and industry.

ASE 545 Special Topics in System Engineering: 3CH (3+0)
Course designed to fulfill special interest in the field of system engineering.

Control and Stability Basket

ASE 448 Control II
Study of control systems components and mathematical models. Amplifiers, DC servomotors, reaction mass actuators. Accelerometers, potentiometers, shaft encoders and resolvers, proximity sensors, force transducers, piezoceramic materials, gyroscopes. Experimental determination of component models and model parameters. Two 3-hour laboratories per week. Computer-aided analysis, design, and simulation, with laboratory hardware-in-the-loop testing. Team design reviews, oral presentations.

ASE 531: Aerospace Avionics: 3CH (3+0)
electrical / electronics system; Radio wave propagation, VHF communication, navigation system; instrument landing systems; distance measuring equipment; transducer. Radar; Avionic system integration and flight control. Avionics equipment troubleshooting and repair.

ASE 534: Flight Traffic Control and Safety: 3CH (3+0)
Air traffic control system, Man-Machine Interface. Accident prevention and investigation.

ASE 538: Dynamics of Unmanned Vehicles: 3CH (3+0)
Dynamics, control and design parameters of unmanned vehicles.

MECH 532: Design of Mechatronic Systems: 3CH (3+0)
Background on mechatronics systems design. Mathematical modeling and computer simulation of mechatronics systems. Control system performance analysis. Comprehensive project involving interfacing sensors and control actuators to microcomputers is given
Prerequisites: MECH 535

MECH 533: Mechanical Vibrations: 3CH (3+0)
This course aims at providing students with knowledge in the area of mechanical vibrations. Topics include: free and forced vibration of one-degree-of-freedom systems; free and forced vibrations of multi-degrees-of-freedom systems; natural frequencies and mode shapes; vibration control; vibration measurement methods; and vibration of continuous systems.
Prerequisite: MECH 310

ASE 539Acoustics and Noise Control: 3CH (3+0)
This course includes the topics of; fundamentals of mechanical vibrations, waves, wave equations and solutions, speech and hearing, environment acoustics, and architectural acoustics, introduction to noise control.
Prerequisite: ASE 425

ASE 535:Special Topics in Aerospace Engineering:
Course designed to fulfill special interest in the field of control and stability.

Appendix B

Undergraduate Degree Requirements
UW-Seattle BSAA program

I. DEGREE REQUIREMENTS

The 180 credit hours of curriculum that qualifies students for the B.S.A.A.E. Degree is shown on page 3. A student entering the University without deficiencies can satisfy these requirements in a 4-year period as shown in the sample 4-year schedule on page 4. A student may wish to take a longer period of time to complete his or her degree and if so, it is strongly recommended that the additional time be taken as a pre-engineering student prior to applying to the Department.

Mathematics: For graduation you need a minimum of 24 credits in mathematics. After satisfying the 18 credits of required courses specified by the College, the department requires that you take MATH 307 (3 cr.) and MATH 324 (3 cr.). Courses lower in level than MATH 124 (i.e. MATH 120) cannot be used to satisfy the mathematics requirements but can be used as free electives. Many students have additional mathematics courses that can apply toward a minor in Mathematics. Check with your advisor.

Natural World. Of the 25 credits required for graduation in the A & A department, 20 credits will be used to satisfy the College requirements in Chemistry; CHEM 142 and Physics; PHYS 121, 122 and 123 and 5 additional credits to satisfy the Department requirement by taking an additional natural world course. Courses to satisfy this requirement must be approved. For those who are intending to apply to other engineering degree programs CHEM 152 is usually a good choice to complete the 25 credits.

Engineering Fundamentals. The 16 credits of courses offered in this area are mainly designed to ensure that you will be acquainted with the fundamental tools of engineering, used not only in your own specialty, but also in other branches of engineering as well. As an engineer, you are expected to be conversant with computer languages. Although, CSE 142, Introduction to Computer Programming or its equivalent, is not currently required for admission or graduation it is recommended as a good choice because it is still required by some other engineering departments. The Department **requires** that AA 210 (Statics), ME 230 (Dynamics), CEE 220 (Introduction to Mechanics of Materials) and AA 260 (Thermodynamics) be completed prior to admission.

Visual, Literary and Performing Arts, or Individuals and Societies: The 24 credits required in this area should be spread out over the four years of your program, and should reflect your own academic objectives and educational goals. You must however, have 10 credits minimum must be in Visual, Literary and Performing Arts, and 10 credits minimum in Individuals and Societies. It is recommended that you take ME 123 (4 cr.) CAD and Visualization to apply towards the VLPA and to gain experience using CAD programming. Use the Areas Knowledge List distributed by the College of Arts and Sciences to help in planning. Skills oriented courses (like; MUSEN, MUSAP) do not apply unless accompanied by history or theory, and ROTC credits are limited to a total of 5 credits that will apply towards the Individuals and Societies requirement.

Written and Oral Communications: 8-12 credits of written and oral communication are required. Of these, 5 credits of writing composition are to be selected from the University Proficiency List to satisfy University of Washington and College minimum requirements. TC 231 (3 credits) Introduction to Technical Writing is also required as part of the 12 credits and is required for admission. TC 333 (4 credits) Advanced Technical Writing and Oral Presentation or a departmentally approved alternative may be used to complete the requirement. "W" courses are considered as applying toward the 12 credits required in this category. It is strongly recommended that TC 333 or alternative course that improves upon those written and oral communication skills be completed by the autumn quarter of the senior year.

Aeronautics and Astronautics: A total of 73 Aeronautics and Astronautics credits are required for the Departmental Program. This is divided into a common third year of 46 specified credits, which includes AMATH 301*, Beginning Scientific Computer that introduces MATLAB, 12 credits of senior requirements, and 15 credits of senior technical electives. Up to six credits of undergraduate research can be counted toward the senior technical electives and with permission of the undergraduate adviser.
one graduate course may also be used.

Free Electives: There are 6-10 credits of free electives depending on your course selections.

B.S.A.A.E. DEGREE CHART
MINIMUM CREDITS REQUIRED
(Students entering the department **Autumn 2009)**

Area	Min. Credit Hrs by Areas	Requirements	
Mathematics	24	MATH 124, 125, 126, 307†, 308†	(21)
		MATH 324	(3)
Natural World	25	CHEM 142 or 145	(5)
		CHEM 152^ or 155	
		Or NW Approved Elective	(5)
		PHYS 121, 122, 123	(15)
Engineering Fundamentals	16	AA 210, CEE 220, ME 230, AA 260, CSE 142 ^	(16-20)
Advanced Writing*	8-12	5 credits written composition plus	(5)
		TC 231, Intro. to Technical Writing	(3)
		TC 333, Advanced Written and Oral Cmu. or departmentally approved alternative including "W" courses.	(0-4)
Visual, Literary & Performing Arts, and Individuals & Societies	24	Total of 24 cr. (minimum of 10 Cr. in each Visual, Literary and Performing Arts, and Individuals and Societies).	(24)
Junior Year Required Core Courses	46	Core Courses: AA 301 302; AA 310 311 312; AA 320 321 322; AA 331 332; AA 496> 360; AMATH 301	(46)
Senior Year Required Core Courses	12	AA 447	(4)
		Integrated Design Sequence AA 410-411 or AA 420-421	(8)
Senior Technical Electives	15	AA Senior Technical Electives	(15)

Free Electives	2-6-10*	Free Electives	(2-6-10)*
Total Credit Hours	180	Total Credit Hours	(180)

† AMATH 351 and 352 can substitute

* Free Electives are variable due to choices in English composition and computer programming.

^ CSE 142 and CHEM 152 Not required but recommended as good choices because they are required by other engineering departments.

> AA 496 is part of the junior year curriculum and must be taken during the junior year even if it was taken previously.

Appendix C

CONTINUATION POLICY FOR UW-SEATTLE BSAA PROGRAM

While the University has general regulations governing scholastic eligibility for continuance, departments and programs in the College of Engineering have adopted additional requirements in order to make the best use of the limited facilities and resources available and to provide reasonable assurance of academic and professional success. The following criteria and procedures will be applied to all undergraduate students for determining continuance in the major program.

I. BASIC CRITERIA

1. Full-time students are expected to complete a minimum of 12 or more credit hours per academic quarter applicable toward the degree. (An average of 15-16 hours per quarter is required to complete the graduation requirements in 12 quarters.)
2. Part-time attendance may be permitted in special cases. but only with prior approval. Written permission must be obtained from the Departmental Undergraduate Advisor or Faculty Advisor for any desired change in status. Application should be made prior to the first day of the quarter. Students who have received permission to attend part-time must complete at least one course applicable toward their degree each quarter.
3. A student who withdraws from the University without prior written approval or is dropped for non-payment of fees must obtain approval of the Undergraduate Advisor before registering or maintaining pre-registration for the following academic year. In such cases registration may be disallowed or canceled if the student's academic record is inferior to the cut-off level for admission prevailing at the time.
4. Any undergraduate student who has exceeded the requirements of the degree program by more than 15 credits and fails to make plans for graduation or received approval for alternative plans will be transferred to the College of Arts and Sciences, Undergraduate Advising Office.
5. a. A student whose grade point average in AA courses falls below 2.0 **in any academic quarter** will be subject to dismissal from the department.
   b. A student who accumulates two or more grades of less than 2.0 in the core AA courses in one or more academic quarters will be subject to probation. To be removed from probation status, the student must achieve grades equal to or greater than 2.0 in all AA courses the following quarter. Failure to achieve this performance level will subject the student to dismissal from the Department.
   c. Any student who accumulates two probationary quarters while enrolled in the Department will also be subject to dismissal.