



CLASS OF 2012

TO: Students Entering Aerospace and Ocean Engineering

FROM: Dr. Chris Hall, Professor and Department Head

SUBJECT: Transfer into Aerospace and Ocean Engineering

Welcome to AOE. We are pleased that you have chosen to join us and we look forward to working with you toward earning a degree in Aerospace Engineering or Ocean Engineering or both. We think you will find this department an exciting place to be, and we hope you will take advantage of all the department has to offer over your next few years with us.

***THE ATTACHED COURSE MATERIAL MAY NOT MATCH THE UNIVERSITY CATALOG LISTING OF OUR CURRICULA. THIS MATERIAL IS YOUR OFFICIAL LISTING OF GRADUATION REQUIREMENTS.***

In the following material you will find up-to-date versions of our academic requirements, including curricular listings for those of you who want to pursue double majors in AE and OE. **It is very important that you keep this information. We have tried to account for all planned changes in the university “core curriculum”; however, past experience has shown the core to change every year. Do not rely on the University Catalog for a correct listing of our curriculum or of the latest version of the Core Curriculum.**

**Please note that your graduation requirements will be those in effect for the year in which you graduate, and not those that were in effect on date of entry.** The university “core curriculum” requirements are, on the other hand, based on *date of entry*. *Should you at any point fall behind your previously planned graduation date you should see your advisor to make sure that delay does not cause you any problems in meeting graduation requirements.*

We look forward to getting to know you and working with you. My office is always open to you should you have any questions about our department, our programs or any other concerns. I am in 214 Randolph Hall, and, should I be in class or otherwise unavailable when you come by, the receptionist will be glad to make an appointment for you.

By the way, in the following material you will find information about our two departmental student branches of international technical society organizations, the AIAA and SNAME. We strongly encourage you to become an active part of at least one of these groups. I can think of no better way to meet other AOE students and faculty and to get involved in the department and invest in your future success.

## Aerospace & Ocean Engineering Departmental Information

**E-MAIL NOTIFICATIONS:** Official notification of important events in AOE or changes to curricula, class scheduling, academic standing, etc. will be sent to you via e-mail. The department maintains e-mail distribution lists for each class. Your class standing for these lists depends on what courses you are taking, not the number of hours you have accumulated. We will use your PID (vt.edu address) so if you prefer to use a different address, use the PID tool to forward your mail to that address. ***Read your e-mail – it could be important!***

**C-MINUS RULE:** The AOE Department requires that students earn a minimum grade of C-minus in all AOE courses that are prerequisites to required AOE courses. Note that the C-requirement does not apply to courses offered by other departments. The purpose of this policy is to help identify those students who may have difficulty with curricular material before those problems build up and ultimately prevent graduation.

The university requires that all students maintain a 2.0 overall GPA for academic eligibility and for graduation. Students must also have an average GPA of 2.0 in their major (all AOE courses) in order to graduate. Occasionally a student will let his or her in-major grades fall below 2.0 even though the overall GPA is well above that mark. Students who enter the senior year with an in-major GPA below 2.0 may find it difficult to attain the required minimum for graduation. The simple rule is that every D grade must be balanced with a B grade.

**ADVISING AND REGISTRATION:** Every student in AOE is assigned an academic advisor who should be able to help him or her with course registration, curricular planning or with any other matter. Experience shows that students are often reluctant to see advisors, even at registration time. This is frustrating to advisors who want to help their advisees and it becomes more frustrating when the student, without proper advice, takes the wrong courses or makes other mistakes that may very well needlessly delay graduation.

The AOE department considers advising an important part of the course registration process. Students should meet with their advisors during the registration period for assistance with any registration and curricular planning problems. Students are encouraged to review their DARS report with their advisor especially before registering for their senior year. *Should you ever feel that you have problems communicating with your advisor or want to change advisors for any reason, see Dr. Hall and a change will be made.*

***Many students end up having to take additional courses beyond the 136 credits required for graduation due to such things as failure to make sure a selected course satisfies a given Core Curriculum area or by taking a course on a P/F or Audit basis and then finding that it doesn't count toward graduation. ALWAYS CONSULT WITH YOUR ADVISOR BEFORE REGISTERING FOR FUTURE TERMS AND BEFORE DROPPING ANY COURSE. Every year students drop courses without considering the need for the course as a prerequisite for later courses, which are only offered once each year. The result can be a full year delay in graduation due to dropping a single course!***

**CAREER ADVISING:** The AOE Department encourages its students to make career planning part of their long term educational process. Co-op and summer employment are definite plusses on a student's resume along with student technical society activities and undergraduate research experience. The department also has an "Academic Career Advisor" to help students with any and all aspects of career planning. Ms. Madhu Kapania is the Career Advisor for AE and OE students, and she will be glad to help our students with resume preparation, job recommendations, etc. She will also refer students to faculty as needed.

**CO-OP:** The AOE Department encourages students to participate in the University Co-op Program and will work with them to develop a practical academic schedule with alternate work and study terms to allow graduation in that program. Co-op is an excellent way to gain valuable “real world” experience, earn extra money and line up a job upon graduation. Ms. Madhu Kapania is the department’s Co-op advisor. Interested students should begin by contacting the Career Services Office.

**COURSE WITHDRAWAL POLICY:** Under this policy, you may withdraw from a course without academic penalty up until the last day of class. You can only do this for six hours of classes during your career at Virginia Tech. ***This policy has the potential for serious misuse leading to major delays in graduation.*** Note that this policy must be used prior to the end of the course in concern and may not be applied afterwards. It also requires the permission of the student’s department and Dean.

**DOUBLE MAJORS and TWO DEGREES:** Many AOE students choose to earn a double major in the “other” curriculum in the department. The double major can be earned with as little as two extra credits of coursework. Programs of study for double majors from both the AE and the OE perspective are listed in the following material. It should be noted that a double major only receives a diploma in the program listed as the “first” major even though both majors are indicated on the student’s transcript. A double major certificate is issued to recognize the second major. The university requires that a graduate desiring two diplomas (called “two degrees”) take a minimum of thirty extra credits even though that many credits may not be needed for completion of the second degree program. It is generally advisable to pursue a masters degree rather than “two degrees” if one has the time to take 30 credits beyond the single BS degree.

Some AOE students may be interested in a second major outside the department. The department will work with students who desire a second major to plan their academic program. While this is rare and often involves significant additional coursework, AOE students have graduated with second majors in Math, Physics, English, Philosophy, Chemistry and other engineering programs. Again, it is generally in one’s best interest to pursue a master’s degree program rather than a second major

**MINORS:** Minors often require significant additional coursework beyond the 136 credits necessary to graduate and are not generally available in engineering majors however, a **math minor**, requires little additional study beyond the math credits which are already a part of the AE and OE curricula. Interested students should contact the Math Department for a list of minor requirements and for the forms needed to sign up for the minor.

**PASS/FAIL COURSES:** All required AOE courses and all math, science and technical electives must be taken on an A/F basis. The university requires that all “core” courses must also be taken for A/F credit. ***Only “free” electives and courses offered only P/F may be taken P/F.***

**TECHNICAL AND MATH ELECTIVES:** Technical and math electives acceptable in the AOE programs of study are listed on pages which follow. Substitutions for these listed courses may be made *with the prior approval of the student’s advisor in cases where a course meets a special career objective or where a new course is not on the list.*

**TIME NEEDED TO GRADUATE:** The curricula in AOE are designed to facilitate graduation in four years (five years for Co-op students). ***Required junior and senior level AOE courses are only offered once per year,*** making it difficult to “stretch” the program over a longer period. The department; however, realizes that some students enter the department later than normal or with less credits than normal and there are others who need to accommodate special programs such as

ROTC or sports participation. Students enrolled in a **ROTC program** must meet the requirements of that program in addition to the AOE graduation requirements. Few ROTC courses will satisfy elective course requirements in the major. ROTC students will usually have to delay taking core and other elective courses to allow room for ROTC course requirements. Unfortunately, ROTC summer training requirements often prevent catching up on delayed courses during summer sessions. With very careful early planning it is possible for the ROTC student to graduate in four years but most will need at least one extra semester for completion of academic and ROTC requirements. We will work with such students to develop the needed schedule of coursework within the restrictions imposed by course teaching schedules, curricular and accreditation requirements, and elective availability.

*Students anticipating any deviation from the listed curriculum for any reason are urged to see their advisor before selecting an alternate schedule. Delaying any of the courses in the curriculum without proper planning and consideration of the consequences can easily cost the student an extra year before graduation because of course sequencing and availability.*

**T**HE SENIOR DESIGN COURSE: AOE 4065, generally has three different sections: Aircraft Design, Spacecraft Design, and Ship design. This course lists “Senior Standing” as a prerequisite, and the intent of this prerequisite is that students in AOE 4065 will have completed all the courses in the junior year of the applicable curriculum. Furthermore, the Spacecraft Design section of AOE 4065 has a prerequisite of AOE 4140 Spacecraft Dynamics and Control, which has a prerequisite of AOE 4134 Astromechanics. Therefore, students wishing to take Spacecraft Design must take AOE 4134 in fall of the junior year and must take AOE 4140 instead of AOE 3134 in spring of the junior year. Students wishing to take Aircraft Design must take AOE 3134 in spring of the junior year.

**T**ECHNICAL AND HONOR SOCIETIES: The AOE Department is fortunate to have three outstanding student sections or branches of national organizations. We strongly recommend student participation in one or both of the two technical societies and an invitation to join the third group will follow good academic performance in the program.

**AIAA** The American Institute of Aeronautics and Astronautics is the leading international technical society for aerospace professionals. The Virginia Tech student branch is among the largest and most active in AIAA. Activities include regular meetings, a regional paper competition and design competitions. Drs. Mason and Woolsey are the AIAA Faculty Advisors.

**SNAME** The Society of Naval Architects and Marine Engineers is the professional society for Ocean Engineers. The Tech student group has been very active and successful in SNAME national programs and design competitions. Members hold regular meetings and highlight their year with a trip to the SNAME national meeting. Dr. Brown is the Faculty Advisor.

**ΣΓΤ** Sigma Gamma Tau is the national Aerospace honor society. Each term ΣΓΤ selects the top AOE juniors and seniors for membership. Both AE and OE students are invited to join. Dr. Hall is the faculty advisor.

**College of Engineering**  
**Department of Aerospace and Ocean Engineering**  
**BACHELOR OF SCIENCE IN AEROSPACE ENGINEERING**  
**For students graduating in calendar year 2011**

FRESHMAN YEAR			
FALL		SPRING	
CHEM	1035	GENERAL CHEMISTRY	3
CHEM	1045	GENERAL CHEMISTRY LAB	1
ENGE	1024	ENGINEERING EXPLORATION	2
ENGL	1105	FRESHMAN ENGLISH	3
MATH	1114	ELEMENTARY LINEAR ALGEBRA	2
MATH	1205	CALCULUS	3
ELECTIVE*			<u>3</u>
			17

SOPHOMORE YEAR			
FALL		SPRING	
AOE	2074	COMPUTATIONAL METHODS	3
AOE	2104	INTRO TO AE	3
ESM	2104	STATICS	3
MATH	2224	MULTIVARIABLE CALCULUS	3
PHYS	2306	FOUNDATIONS OF PHYSICS I	4
ELECTIVE*			<u>1</u>
			17

JUNIOR YEAR			
FALL		SPRING	
AOE	3014	AERO/HYDRODYNAMICS	3
AOE	3024	THIN-WALLED STRUCTURES	3
AOE	3034	VEHICLE VIBRATION AND CONTROL	3
MATH	4564	OPERATIONAL METHODS	3
ME	3134	FUND OF THERMODYNAMICS	3
ELECTIVE*			<u>3</u>
OR			<u>3</u>
AOE	4134	ASTROMECHANICS	3
			18

+ Choice of Math 4574 (Vector and Complex Analysis for Engineers) or Math/AOE 4404 (Applied Numerical Methods) or Stat 4705 (Probability and Statistics for Engineers)

SENIOR YEAR			
FALL		SPRING	
AOE	3044	BOUNDARY LAYER THEORY	3
AOE	4065	DESIGN **	3
AOE	4134	ASTROMECHANICS	3
OR		(OPPOSITE OF JUNIOR YR. CHOICE)	3
ELECTIVE*			<u>3</u>
AOE	4154	AERO ENGR LAB	1
AOE	4234	AEROSPACE PROPULSION SYSTEMS	3
TECHNICAL ELECTIVES++			<u>3</u>
			16

In order to enter this restricted major, students must have:

- 1) A minimum 2.0 GPA overall
- 2) A minimum grade of C- or better in ENGE 1024 and ENGE 1114
- 3) Credit for MATH 1205, 1206, 1114, 1224; CHEM 1035, 1045; ENGL 1105, 1106; PHYS 2305; ENGE 1024

**Satisfactory Progress:** In addition to the requirements of University Policy 91, after attempting 72 credit hours, students must have passed AOE 2074 and AOE 3104, and after attempting 108 credit hours, students must have passed 24 credit hours of in-major courses and have 2.0 overall and in-major GPAs.

\* Electives include 6 credits each from Curriculum for Liberal Education (CLE) Areas 2 and 3, 1 credit from CLE Area 6, and 3 credits from CLE Area 7 (the area 7 course may double count with area 2 or 3). *The AOE Department requires that Econ 2005 (Principles of Economics) be one of the courses taken in Area 3.* The elective credits must include a 1-3 credit computer programming course in C++ or FORTRAN selected from the following: CS 1044 (Introduction to Programming in C), ENGE 2314 (Engineering Problem Solving With C++), ENGE 2324 (Engineering Problem Solving Using Fortran). Other C++ or FORTRAN courses may be approved by your advisor. Three to eight credits will be free electives.

\*\* AE MAJORS MAY TAKE EITHER AIRCRAFT OR SPACECRAFT DESIGN

++ The AOE Department requires 9 credits of technical electives of which 6 credits must be an AOE course and the remaining 3 may be selected from a list of 3000 level and higher AOE and other approved technical courses.

**THERE ARE NO HIDDEN PREREQUISITES IN THIS PROGRAM OF STUDY**

Students must have had 2 years of a foreign language in high school or one year at the college level. College-level credits used to meet this requirement do not count towards the degree.

The "in-major GPA" consists of all courses taken under the AOE designation.

Students must pass all required courses and both the in-major and overall GPA must be at least 2.0 for graduation.

Only free electives and courses only offered on a Pass/Fail basis may be taken Pass/Fail.

**136 CREDITS ARE REQUIRED FOR GRADUATION.**

**NOTE: See the attached list of courses that do not count toward graduation credits.**

**College of Engineering**  
**Department of Aerospace and Ocean Engineering**  
**BACHELOR OF SCIENCE IN OCEAN ENGINEERING**  
**For students graduating in calendar year 2011**

FRESHMAN YEAR							
FALL				SPRING			
CHEM	1035	GENERAL CHEMISTRY	3	ENGE	1114	EXPLORATION OF ENGINEERING DESIGN	2
CHEM	1045	GENERAL CHEMISTRY LAB	1	ENGL	1106	FRESHMAN ENGLISH	3
ENGE	1024	ENGINEERING EXPLORATION	2	MATH	1206	CALCULUS	3
ENGL	1105	FRESHMAN ENGLISH	3	MATH	1224	VECTOR GEOMETRY	2
MATH	1114	ELEMENTARY LINEAR ALGEBRA	2	PHYS	2305	FOUNDATIONS OF PHYSICS I	4
MATH	1205	CALCULUS	3	ELECTIVE*			3
ELECTIVE*			3				3
			17				17

SOPHOMORE YEAR							
FALL				SPRING			
AOE	2074	COMPUTATIONAL METHODS	3	AOE	3094	MATERIALS FOR AERO & OCEAN ENG	3
AOE	2204	INTRO TO AE	3	AOE	3204	NAVAL ARCHITECTURE	3
ESM	2104	STATICS	3	ESM	2204	MECHANICS OF DEFORMABLE BODIES	3
MATH	2224	MULTIVARIABLE CALCULUS	3	ESM	2304	DYNAMICS	3
PHYS	2306	FOUNDATIONS OF PHYSICS I	4	MATH	2214	INTRO DIFF EQUATIONS	3
ELECTIVE*			1	ELECTIVE*			3
			17				18

JUNIOR YEAR							
FALL				SPRING			
AOE	3014	AERO/HYDRODYNAMICS	3	AOE	3054	AOE EXPERIMENTAL METHODS	3
AOE	3024	THIN-WALLED STRUCTURES	3	AOE	3224	OCEAN STRUCTURES	3
AOE	3034	VEHICLE VIBRATION AND CONTROL	3	AOE	3264	RESISTANCE & PROPULSION OF SHIPS	3
MATH	4564	OPERATIONAL METHODS	3	AOE	4214	OCEAN WAVE MECHANICS	3
ME	3134	FUNDAMENTALS OF THERMODYNAMICS	3	AOE	4244	MARINE ENGINEERING	3
ELECTIVE*			3	STAT	4705	PROBABILITY AND STATISTICS FOR ENGINEERS	3
			18				18

SENIOR YEAR							
FALL				SPRING			
AOE	3044	BOUNDARY LAYER THEORY	3	AOE	4066	DESIGN **	3
AOE	4065	DESIGN **	3			TECHNICAL ELECTIVES++	3
AOE	4254	OCEAN ENGINEERING LABORATORY	1			ELECTIVES*	9
AOE	4334	SHIP DYNAMICS	3				15
TECHNICAL ELECTIVES++			6				
			16				

In order to enter this restricted major, students must have:

- 1) A minimum 2.0 GPA overall
- 2) A minimum grade of C- or better in ENGE 1024 and ENGE 1114
- 3) Credit for MATH 1205, 1206, 1114, 1224; CHEM 1035, 1045; ENGL 1105, 1106; PHYS 2305; ENGE 1024

**Satisfactory Progress:** In addition to the requirements of University Policy 91, after attempting 72 credit hours, students must have passed AOE 2074 and AOE 3104, and after attempting 108 credit hours, students must have passed 24 credit hours of in-major courses and have 2.0 overall and in-major GPAs.

\* Electives include 6 credits each from Curriculum for Liberal Education (CLE) Areas 2 and 3, 1 credit from CLE Area 6, and 3 credits from CLE Area 7 (the area 7 course may double count with area 2 or 3). *The AOE Department requires that Econ 2005 (Principles of Economics) be one of the courses taken in Area 3.* The elective credits must include a 1-3 credit computer programming course in C++ or FORTRAN selected from the following: CS 1044 (Introduction to Programming in C), ENGE 2314 (Engineering Problem Solving With C++), ENGE 2324 (Engineering Problem Solving Using Fortran). Other C++ or FORTRAN courses may be approved by your advisor. Three to eight credits will be free electives.

\*\* OE MAJORS MUST TAKE SHIP DESIGN

++ The AOE Department requires 9 credits of technical electives of which 6 credits must be an AOE course and the remaining 3 may be selected from a list of 3000 level and higher AOE and other approved technical courses.

**THERE ARE NO HIDDEN PREREQUISITES IN THIS PROGRAM OF STUDY**

Students must have had 2 years of a foreign language in high school or one year at the college level. College-level credits used to meet this requirement do not count towards the degree.

The "in-major GPA" consists of all courses taken under the AOE designation.

Students must pass all required courses and both the in-major and overall GPA must be at least 2.0 for graduation.

Only free electives and courses only offered on a Pass/Fail basis may be taken Pass/Fail.

**136 CREDITS ARE REQUIRED FOR GRADUATION.**

**NOTE:** See the attached list of courses that do not count toward graduation credits

**College of Engineering, Department of Aerospace and Ocean Engineering**  
**BACHELOR OF SCIENCE IN AEROSPACE ENGINEERING**  
**WITH A DOUBLE MAJOR IN OCEAN ENGINEERING**  
**For students graduating in calendar year 2011**

FRESHMAN YEAR							
FALL				SPRING			
CHEM	1035	GENERAL CHEMISTRY	3				
CHEM	1045	GENERAL CHEMISTRY LAB	1	ENGE	1114	EXPLORATION OF ENGINEERING DESIGN	2
ENGE	1024	ENGINEERING EXPLORATION	2	ENGL	1106	FRESHMAN ENGLISH	3
ENGL	1105	FRESHMAN ENGLISH	3	MATH	1206	CALCULUS	3
MATH	1114	ELEMENTARY LINEAR ALGEBRA	2	MATH	1224	VECTOR GEOMETRY	2
MATH	1205	CALCULUS	3	PHYS	2305	FOUNDATIONS OF PHYSICS I	4
ELECTIVE*			<u>3</u>	ELECTIVE*			<u>3</u>
			17				17

SOPHOMORE YEAR							
FALL				SPRING			
AOE	2074	COMPUTATIONAL METHODS	3	AOE	3094	MATERIALS FOR AERO & OCEAN ENG	3
AOE	2104	INTRO TO AE	3	AOE	3104	AIRCRAFT PERFORMANCE	3
ESM	2104	STATICS	3	AOE	3204	NAVAL ARCHITECTURE	3
MATH	2224	MULTIVARIABLE CALCULUS	3	ESM	2204	MECHANICS OF DEFORMABLE BODIES	3
PHYS	2306	FOUNDATIONS OF PHYSICS I	4	ESM	2304	DYNAMICS	3
ELECTIVE*			<u>1</u>	MATH	2214	INTRO DIFF EQUATIONS	<u>3</u>
			17				18

JUNIOR YEAR																
FALL				SPRING												
AOE	3014	AERO/HYDRODYNAMICS	3	AOE	3054	AOE EXPERIMENTAL METHODS	3									
AOE	3024	THIN-WALLED STRUCTURES	3	AOE	3114	COMPRESSIBLE AERODYNAMICS	3									
AOE	3034	VEHICLE VIBRATION AND CONTROL	3	AOE	3124	AEROSPACE STRUCTURES	3									
AOE	4134	ASTROMECHANICS	3	<table style="width: 100%; border-collapse: collapse;"> <tr> <td style="border: 1px solid black; padding: 2px;">AOE</td><td style="border: 1px solid black; padding: 2px;">3134</td><td style="border: 1px solid black; padding: 2px;">STABILITY &amp; CONTROL</td><td style="border: 1px solid black; padding: 2px; text-align: right;">3</td> </tr> <tr> <td colspan="4" style="text-align: center; padding: 2px;">OR</td> </tr> <tr> <td style="border: 1px solid black; padding: 2px;">AOE</td><td style="border: 1px solid black; padding: 2px;">4140</td><td style="border: 1px solid black; padding: 2px;">SPACECRAFT DYNAMICS &amp; CONTROL</td><td style="border: 1px solid black; padding: 2px; text-align: right;">3</td> </tr> </table>	AOE	3134	STABILITY & CONTROL	3	OR				AOE	4140	SPACECRAFT DYNAMICS & CONTROL	3
AOE	3134	STABILITY & CONTROL	3													
OR																
AOE	4140	SPACECRAFT DYNAMICS & CONTROL	3													
MATH	4564	OPERATIONAL METHODS	3	AOE	3264	RESISTANCE & PROPULSION OF SHIPS	3									
ME	3134	FUNDAMENTALS OF THERMODYNAMICS	<u>3</u>	AOE	4214	OCEAN WAVE MECHANICS	<u>3</u>									
			18				18									

**SUMMER SESSION:** ELECTIVES\* 1 - 4cr AS NEEDED TO COMPLETE THE CURRICULUM FOR LIBERAL EDUCATION OR COMPUTER PROGRAMMING COURSE

SENIOR YEAR							
FALL				SPRING			
AOE	3044	BOUNDARY LAYER THEORY	3	AOE	3224	OCEAN STRUCTURES	3
AOE	4334	SHIP DYNAMICS	3	AOE	4066	DESIGN **	3
AOE	4065	DESIGN **	3	AOE	4244	MARINE ENGINEERING	3
AOE	4234	AEROSPACE PROPULSION SYSTEMS	3	STAT	4705	PROBABILITY AND STATISTICS FOR ENGINEERS	3
AOE	4154	AERO ENGR LAB	1	ELECTIVES*			<u>3</u>
AOE	4254	OCEAN ENGINEERING LABORATORY	1				15
ELECTIVES*			<u>3</u>				
			17				

In order to enter this restricted major, students must have:

- 1) A minimum 2.0 GPA overall
- 2) A minimum grade of C- or better in ENGE 1024 and ENGE 1114
- 3) Credit for MATH 1205, 1206, 1114, 1224; CHEM 1035, 1045; ENGL 1105, 1106; PHYS 2305; ENGE 1024

**Satisfactory Progress:** In addition to the requirements of University Policy 91, after attempting 72 credit hours, students must have passed AOE 2074 and AOE 3104, and after attempting 108 credit hours, students must have passed 24 credit hours of in-major courses and have 2.0 overall and in-major GPAs.

\* Electives include 6 credits each from Curriculum for Liberal Education (CLE) Areas 2 and 3, 1 credit from CLE Area 6, and 3 credits from CLE Area 7 (the area 7 course may double count with area 2 or 3). *The AOE Department requires that Econ 2005 (Principles of Economics) be one of the courses taken in Area 3.* The elective credits must include a 1-3 credit computer programming course in C++ or FORTRAN selected from the following: CS 1044 (Introduction to Programming in C), ENGE 2314 (Engineering Problem Solving With C++), ENGE 2324 (Engineering Problem Solving Using Fortran). Other C++ or FORTRAN courses may be approved by your advisor. There are no free electives.

\*\*AE / OE DOUBLE MAJORS MUST TAKE EITHER AIRCRAFT OR SPACECRAFT DESIGN

**THESE ARE NO HIDDEN PREREQUISITES IN THIS PROGRAM OF STUDY**

Students must have had 2 years of a foreign language in high school or one year at the college level. College-level credits used to meet this requirement do not count towards the degree. The "in-major GPA" consists of all courses taken under the AOE designation.

Students must pass all required courses and both the in-major and overall GPA must be at least 2.0 for graduation.

Only free electives and courses only offered on a Pass/Fail basis may be taken Pass/Fail.

138 - 141 CREDITS ARE REQUIRED FOR GRADUATION.

**NOTE:** See the attached list of courses that do not count toward graduation credits.

**College of Engineering**  
**Department of Aerospace and Ocean Engineering**  
**BACHELOR OF SCIENCE IN OCEAN ENGINEERING**  
**WITH A DOUBLE MAJOR IN AEROSPACE ENGINEERING**  
**For students graduating in calendar year 2011**

**FRESHMAN YEAR**

FALL				SPRING			
CHEM	1035	GENERAL CHEMISTRY	3	ENGE	1114	EXPLORATION OF ENGINEERING DESIGN	2
CHEM	1045	GENERAL CHEMISTRY LAB	1	ENGL	1106	FRESHMAN ENGLISH	3
ENGE	1024	ENGINEERING EXPLORATION	2	MATH	1206	CALCULUS	3
ENGL	1105	FRESHMAN ENGLISH	3	MATH	1224	VECTOR GEOMETRY	2
MATH	1114	ELEMENTARY LINEAR ALGEBRA	2	PHYS	2305	FOUNDATIONS OF PHYSICS I	4
MATH	1205	CALCULUS	3	ELECTIVE*			3
ELECTIVE*			3				3
			17				17

**SOPHOMORE YEAR**

FALL				SPRING			
AOE	2074	COMPUTATIONAL METHODS	3	AOE	3094	MATERIALS FOR AERO & OCEAN ENG	3
AOE	2204	INTRO TO AE	3	AOE	3104	AIRCRAFT PERFORMANCE	3
ESM	2104	STATICS	3	AOE	3204	NAVAL ARCHITECTURE	3
MATH	2224	MULTIVARIABLE CALCULUS	3	ESM	2204	MECHANICS OF DEFORMABLE BODIES	3
PHYS	2306	FOUNDATIONS OF PHYSICS I	4	ESM	2304	DYNAMICS	3
ELECTIVE*			1	MATH	2214	INTRO DIFF EQUATIONS	3
			17				18

**JUNIOR YEAR**

FALL				SPRING			
AOE	3014	AERO/HYDRODYNAMICS	3	AOE	3054	AOE EXPERIMENTAL METHODS	3
AOE	3024	THIN-WALLED STRUCTURES	3	AOE	3114	COMPRESSIBLE AERODYNAMICS	3
AOE	3034	VEHICLE VIBRATION AND CONTROL	3	AOE	3224	OCEAN STRUCTURES	3
AOE	4134	ASTROMECHANICS	3	AOE	3264	RESISTANCE & PROPULSION OF SHIPS	3
MATH	4564	OPERATIONAL METHODS	3	AOE	4214	OCEAN WAVE MECHANICS	3
ME	3134	FUNDAMENTALS OF THERMODYNAMICS	3	AOE	4244	MARINE ENGINEERING	3
			18				18

**SUMMER SESSION:** ELECTIVES\* 1 - 4cr AS NEEDED TO COMPLETE THE CURRICULUM FOR LIBERAL EDUCATION OR COMPUTER PROGRAMMING COURSE

**SENIOR YEAR**

FALL				SPRING			
AOE	3044	BOUNDARY LAYER THEORY	3	AOE	3124	AEROSPACE STRUCTURES	3
AOE	4065	DESIGN**	3	AOE	3134	STABILITY & CONTROL	3
AOE	4234	AEROSPACE PROPULSION SYSTEMS	3		OR		
AOE	4154	AERO ENGR LAB	1	AOE	4140	SPACECRAFT DYNAMICS & CONTROL	3
AOE	4254	OCEAN ENGINEERING LABORATORY	1	AOE	4066	DESIGN**	3
AOE	4334	SHIP DYNAMICS	3	STAT	4705	PROBABILITY AND STATISTICS FOR ENGINEERS	3
ELECTIVES*			3	ELECTIVES*			3
			17				15

In order to enter this restricted major, students must have:

- 1) A minimum 2.0 GPA overall
- 2) A minimum grade of C- or better in ENGE 1024 and ENGE 1114
- 3) Credit for MATH 1205, 1206, 1114, 1224; CHEM 1035, 1045; ENGL 1105, 1106; PHYS 2305; ENGE 1024

**Satisfactory Progress:** In addition to the requirements of University Policy 91, after attempting 72 credit hours, students must have passed AOE 2074 and AOE 3104, and after attempting 108 credit hours, students must have passed 24 credit hours of in-major courses and have 2.0 overall and in-major GPAs.

\* Electives include 6 credits each from Curriculum for Liberal Education (CLE) Areas 2 and 3, 1 credit from CLE Area 6, and 3 credits from CLE Area 7 (the area 7 course may double count with area 2 or 3). *The AOE Department requires that Econ 2005 (Principles of Economics) be one of the courses taken in Area 3.* The elective credits must include a 1-3 credit computer programming course in C++ or FORTRAN selected from the following: CS 1044 (Introduction to Programming in C), ENGE 2314 (Engineering Problem Solving With C++), ENGE 2324 (Engineering Problem Solving Using Fortran). Other C++ or FORTRAN courses may be approved by your advisor. There are no free electives.

\*\* OE / AE DOUBLE MAJORS MUST TAKE SHIP DESIGN

**THERE ARE NO HIDDEN PREREQUISITES IN THIS PROGRAM OF STUDY**

Students must have had 2 years of a foreign language in high school or one year at the college level. College-level credits used to meet this requirement do not count towards the degree.

The "in-major GPA" consists of all courses taken under the AOE designation.

Students must pass all required courses and both the in-major and overall GPA must be at least 2.0 for graduation.

Only free electives and courses only offered on a Pass/Fail basis may be taken Pass/Fail.

138 - 141 CREDITS ARE REQUIRED FOR GRADUATION.

**NOTE:** See the attached list of courses that do not count toward graduation credits.

## Non-Degree Credit Courses

Please be aware that not all courses for which you have credit at Virginia Tech will count toward an undergraduate engineering degree. Such courses may not be used to satisfy any graduation requirement, including free electives. Listed below are courses which do not count toward an undergraduate engineering degree. This list is subject to change. A current list is maintained at [http://www.eng.vt.edu/overview/docs/non\\_degree\\_courses.pdf](http://www.eng.vt.edu/overview/docs/non_degree_courses.pdf)

AtSc 2984	Athletic Transitions
AtSc 2984	Exploring Careers
COS 2984	Athletic Transitions
COS 2984	Exploring Careers
CS 1004	Computer Literacy
CEE 4984	Review of CE Fundamentals of FE Exam
EDCI 1004,	College Success Strategies
EDCI 1014	Cadet Success Strategies
EDCI 2984	Cadet Success Strategies
EDCI 2984	College Success Strategies
EDHL 2984	Resident Education
EDHL 2984	Leadership from International Perspective
EDHL 2984	Healthy Living
EDHL 4964	Field Study
EDHL 4984	Orientation Skills
EDHL 4984	Orientation/Peers
EDHL 4984	Orientation/Leader
EDHL 4974	Wing Student Teaching Assistant
EF/ENGE 2984	Engineering Success Seminar
Engl 1004	English as a Second Language
Engl 0014	English as a Second Language
ENGR 1014	ENGR Research Seminar
ENGR 1034	First Year Hypatia Seminar
ENGR 2044	Second Year Hypatia Seminar
ENGR 1054	First Year Galileo Seminar
ENGR 2984	C Aspired Seminar
ENGR 2984	College Success Strategies for Engineers
ENGR 2984	Engineering Success Strategies
ENGR 2984	Women in Engineering
ENGR 2984	Hypatia Seminar
ENGR 2984	Engineering Honors Seminar
ENGR 2984	Freshman Engineering Seminar
ENGR 2984	Mentoring Seminar
ENGR 3004	Mentoring Seminar
ENGR 4984	CEED Team Leader Seminar
ESM 2984	ESP Statics
ESM 4404	Fundamentals of Professional Engineering
FCD 2984	Success Project
HD 2984	Healthy Living
HD 2984	Success Project
MaSc 1024	Mathematics, A Liberal Arts Approach
MaSc 1034	Statistics, A Liberal Arts Approach
MaSc 1044	Computer Science, A Liberal Arts Approach
Math 1504	Pre Calculus
Math 2984	Emerging Scholar
Math 1015/1016	Elementary Calculus with Trig.
Math 1525/1526	Elementary Calculus with Matrices
Math 2015/2016	Elementary Calculus with Trig. II
ME 4984	SAE Automotive
Phys 2205/2206	General Physics, not Calc-based
Psyc 2984	Athletic Transitions
Psyc 2984	First Year Experience

## **AOE DEPARTMENT ELECTIVE POLICIES AND REQUIREMENTS**

### **For students graduating in calendar year 2011**

*AOE students have several types of electives required in their program of study. Listed below are departmental, College and University requirements governing those electives.*

**CURRICULUM FOR LIBERAL EDUCATION (CLE):** Satisfaction of CLE requirements is required of all students in the university. Engineering students satisfy this requirement in Areas 1, 4, and 5 through curricular math, science and English courses. Areas 2, 3, 6, and 7 are satisfied through elective courses; 6 credits are required in Areas 2 and 3, 1 credit in Area 6 and 3 credits in Area 7. The one course required for Area 7 may, if carefully selected, simultaneously satisfy an Area 2 or 3 requirement. Several courses appear on both the Area 2 and Area 6 lists but can be used to satisfy only one of these requirements. Area 7 is the only area in which a course may “double count”. **All CLE requirements must be met with courses taken on an A/F basis unless a course is only offered on the P/F basis.** A link to the *University Curriculum for Liberal Education Guide* is maintained at <http://www.provost.vt.edu/>. Each year, courses may be added to or removed from each Area. A course may be used to satisfy an Area if it appears on the list of approved courses for that Area during the year it was taken.

**ECON 2005 (Principles of Economics)** is required for graduation and may be taken as one of the two Area 3 requirements in the CLE. If a student chooses to satisfy the Area 3 requirements with courses not including ECON 2005, ISE 2014 (Engineering Economy) may also be used to satisfy this requirement but this requires additional credits.

#### **VISUAL EXPRESSION, WRITING AND SPEAKING (ViEWS) Requirement (Writing Intensive requirement)**

The ViEWS (or Writing Intensive) requirement will be met by taking the required senior level design courses (AOE 4065 and 4066) in the major.

**MATH ELECTIVE:** All AE students must take either Math 4574 (Vector and Complex Analysis for Engineers), Math/AOE 4404 (Applied Numerical Methods) or Statistics 4705 (Probability and Statistics for Engineers) on an A/F basis. (Statistics 4705 is required for OE majors.)

**TECHNICAL ELECTIVES:** The AOE Department requires 9 credits of technical electives, all of which must be taken on an A/F basis. This includes 6 credits of AOE courses at the 3000 level or above and 3 credits from the list below. Students pursuing both AE and OE majors will fill all technical elective requirements with required courses from their second major. Courses other than those below may be acceptable as technical electives; however any substitutions must be approved by the student’s course advisor *before the course is taken*. Students are responsible for the satisfaction of prerequisites required for their chosen technical electives.

AOE: Any 3000 or higher level course not required in the student’s major.

CEE: 4674

ECE: 4405, 4406, 4624, 4634, 4644

ESM: 3054, 4024, 4044, 4114, 4154, 4614, 4714

GEOG: 4354

GEOS: 3114, 3034

ISE: 4404

MSE: 4055, 4056

MATH: 3214, 4144, 4225, 4226, 4234, 4245, 4246, 4425, 4426, 4445, 4446, 4574 (if not used as the math elective)

ME: 4204, 4224, 4254, 4504, 4514, 4524, 4534, 4634, 4644, 4704, 4724, 4734

PHYS: 3405, 3406, 3655, 3656, 4455, 4456, 4504, 4554, 4614

STAT: 4105, 4106, 4705 (AE only, if not used as the math elective), 4706

**FREE ELECTIVES:** May be any course you care to take (with the exception of the non-degree credit courses in the attached list) including PE, ROTC, Band, etc. If you have transfer credits or AP credit that did not satisfy one of your curriculum requirements, these will work as free elective credits. Free electives may be taken on a P/F basis provided the student meets the requirements for taking courses P/F and the course is offered on that basis.

## Course Prerequisites Aerospace and Ocean Engineering

Semester	Course	Pre(Co)requisite	Pre(Co)requisite For
1 <sup>st</sup> Yr Fall			
	CHEM 1035 Gen Chemistry I		AOE 3094, Co: CHEM 1045
	CHEM 1045 Chemistry Lab I	Co: CHEM 1035	
	ENGE 1024 Engineering Exploration	Co: MATH 1205	ENGE 1114
	ENGL 1105 English I		ENGL 1106
	MATH 1205 Calculus I		MATH 1206, 1224, PHYS 2305, Co: ENGE 1024
	MATH 1114 Linear Algebra		ESM 2104, Co: MATH 1224
1 <sup>st</sup> Yr Spring			
	ENGE 1114 Explor of Engr Design	ENGE 1024	AOE 2074, 2104, 2204
	ENGL 1106 English II	ENGL 1105	
	MATH 1206 Calculus II	MATH 1205	MATH 2224, PHYS 2306 Co: MATH 1224, PHYS 2305
	MATH 1224 Vector Geometry	MATH 1205, CO: MATH 1114, 1206	MATH 2224
	PHYS 2305 Physics I	MATH 1205, Co: MATH 1206	AOE 2104, 2204, PHYS 2306, Co: AOE 3094
2 <sup>nd</sup> Yr Fall			
	AOE/ESM 2074 Comput Methods	ENGE 1114, Co: MATH 2224	
(AE)	AOE 2104 Intro to Aerospace Engr	ENGE 1114, PHYS 2305	
(OE)	AOE 2204 Intro to Ocean Engr	ENGE 1114, PHYS 2305	
	ESM 2104 Statics	MATH 1114, Co: MATH 2224	AOE 3024, 3104, 3204
	MATH 2224 Multivariable Calculus	MATH 1206, MATH 1224	AOE 3204, ESM 2204, ESM 2304, STAT 4705, Co: AOE 2074, ESM 2104
	PHYS 2306 Physics II	MATH 1206, PHYS 2305	
2 <sup>nd</sup> Yr Spring			
	AOE 3094 AOE Materials	CHEM 1035, Co: ESM 2204, PHYS 2305	
(AE)	AOE 3104 Aircraft Performance	ESM 2104, Co: ESM 2304	All 3000 & higher level AOE courses
(OE)	AOE 3204 Naval Architecture	ESM 2104, MATH 2224, Co: ESM 2304	All 3000 & higher level AOE courses
	ESM 2204 Mech of Def Bodies	ESM 2104, MATH 2224	AOE 3024, Co: AOE 3094
	ESM 2304 Dynamics	ESM 2104, MATH 2224, Co: MATH 2214	AOE 3014, 3034, 4134, Co: AOE 3104, 3204
	MATH 2214 Differential Equations	MATH 1114, 1206	AOE 3034, MATH 4564, ME 3134, Co: ESM 2304

(continued on next page)

**Course Prerequisites (continued)**  
**Aerospace and Ocean Engineering**

Semester	Course	Pre(Co)requisite	Pre(Co)requisite For
3 <sup>rd</sup> Yr Fall			
	AOE 3014 Aero/Hydrodynamics	AOE 3104 or 3204, ESM 2304	AOE 3054, 3044, 3114, 3264, 4214, 4334
	AOE 3024 Thin-Wall Structures	ESM 2204	AOE 3054, 3124, 3224
	AOE 3034 Vibration & Control	ESM 2304, Math 2214	AOE 3054, 3134, 4140, 4334
(AE)	AOE 4134 Astromechanics	ESM 2304	AOE 4140
	MATH 4564 Oper Methods for Engr	Math 2214	AOE 3044, 4214, 4334
	ME 3134 Thermodynamics	Math 2214	AOE 3044, 3114, 4234, 4244
3 <sup>rd</sup> Yr Spring			
	AOE 3054 Exp. Methods	AOE 3014, 3024, 3034	AOE 4154, 4254
(AE)	AOE 3114 Compressible Aerodyn	AOE 3014, ME 3134	AOE 4154, 4234
(AE)	AOE 3124 A/C Structures	AOE 3024	AOE 4154
(AE)	AOE 3134 Stability & Control	AOE 3034	AOE 4154
(OE)	AOE 3264 Resist & Propulsion	AOE 3014, 3204	AOE 4254
(OE)	AOE 3224 Ocean Structures	AOE 3024	
(AE)	AOE 4140 Spacecraft Dynamics & Control	AOE 3034, 4134	AOE 4065, 66 (Space Design), 4154
(OE)	AOE 4214 Ocean Wave Mechanics	AOE 3014, MATH 4564	AOE 4334
(OE)	AOE 4244 Marine Engineering	AOE 3204, ME 3124 or 3134	
(OE)	STAT 4705 Prob & Statistics For Engr	MATH 2224	
4 <sup>th</sup> Yr Fall			
	AOE 3044 Boundary Layer & Heat Transfer	AOE 3014, MATH 4564, ME 3134	
	AOE 4065 Design I	Senior Standing	AOE 4066
(AE)	AOE 4134 Astromechanics	ESM 2304	AOE 4140
(AE)	AOE 4154 Aerospace Engineering Lab	AOE 3054,3114, 3124, 3134 or 4140	
(AE)	AOE 4234 Aerospace Propulsion	AOE 3114, ME 3134	
(OE)	AOE 4254 OE Lab	AOE 3054, 3264	
(OE)	AOE 4334 Ship Dynamics	AOE 3014, 3034, 4214, MATH 4564	
4 <sup>th</sup> Yr Spring			
	AOE 4066 Design II	AOE 4065	

# AOE ELECTIVE CHECK SHEET

AE and OE majors are required to take 34 credits of electives. This includes nine credits of technical electives, a three credit Math elective (OE majors must take Stat 4705 as their math elective), and twenty two other credits including Areas 2, 3, 6, and 7 of the University Core Curriculum and three to eight credits of “free electives”. All electives except “free electives” must be taken for a grade unless the course is offered P/F only.

**TECHNICAL ELECTIVES:** *Six credits must be 3000 level or higher AOE courses which are not otherwise required in the student’s major and three credits can be 3000 level or higher courses in or out of AOE from the AOE Technical Elective List.*

<b>AOE Technical Electives:</b>	_____ , _____	<b>6 cr</b>
<b>Other Tech. Electives:</b>	_____	<b>3 cr</b>

**NOTE:** AOE students pursuing a double major will use required courses from their second major to fill the above elective slots

<b>MATH ELECTIVE:</b> <i>MATH 4574, AOE 4404, OR STAT 4705</i> <i>(STAT 4705 is required for Ocean Engineering majors)</i>	_____	<b>3 cr</b>
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**CORE, COMPUTER, AND FREE ELECTIVES:**

<b>Area 2:</b>	_____ , _____	<b>6 cr</b>
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<b>Area 3: (include Econ 2005 or add ISE 2014 as extra requirement)</b>	_____ , _____	<b>6 cr</b>
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<b>Area 6: (one credit required, excess credits should be listed as “free” elective)</b>	_____	<b>1 cr</b>
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<b>Area 7 or “Free” Elective</b> <b>(This space can be filled with a “free” elective if an Area 7 course was used in Areas 2 or 3)</b>	_____	<b>3 cr</b>
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<b>Programming Elective: CS 1044, ENGE 2314, or ENGE 2324</b>	_____	<b>1 - 3 cr</b>
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<b>“Free” Electives</b>	_____ , _____	<b>3 - 5 cr</b>
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(Free electives can include any course taught by the university which does not duplicate required courses or electives or *which is not otherwise defined as not counting for graduation in engineering. See the list of these above.*)

<b>TOTAL ELECTIVES</b>	_____
	<b>34 cr</b>