Do Not Discard!

Aerospace and Ocean Engineering

VIRGINIA POLYTECHNIC INSTITUTE
AND STATE UNIVERSITY

Blacksburg, Virginia 24061-0203
(540) 231-6611 Fax: (540) 231-9632

Virginia Tech

CLASS of 2018

TO: Students Entering Aerospace and Ocean Engineering
FROM: Dr. Eric Paterson, 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 majoring in Aerospace Engineering (AE) or Ocean Engineering (OE) 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.

In the following material you will find up-to-date versions of our academic requirements. **It is very important that you keep this information.** The University Registrar maintains the official curricular listings for majors in AE and OE, called check sheets. **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.***

http://www.registrar.vt.edu/graduation/checksheets/index.html

On the other hand, Curriculum for Liberal Education (CLE) requirements are based on *date of entry*. Courses satisfying the CLE requirements may change every year. Please refer to the CLE website, http://www.cle.prov.vt.edu/guides/, for up to date information. If you fall behind your previously planned graduation date, then you should see your advisor to make sure that delay does not cause you any problems in meeting graduation requirements.

In the following material you will find information about our two departmental student branches of international technical society organizations, the AIAA and SNAME/ASNE. 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.

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 215 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.

Aerospace & Ocean Engineering
Departmental Information

EMAIL NOTIFICATIONS: Official notification of important events in AOE or changes to curricula, class scheduling, academic standing, etc. will be sent to you via email. The department maintains email 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 email—it could be important!***

ADVISING and REGISTRATION: Ms. Madhu Kapania is your academic advisor who may help with course registration, curricular planning or with any other matter. Every student in AOE is also assigned a faculty advisor for academic and career advice. 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 becomes more frustrating when the student, without proper advice, takes the wrong courses or makes other mistakes that may 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 use the Degree Audit Reporting System (DARS) and review the report with their advisor, especially before registering for senior year. Should you ever feel that you have problems communicating with your advisor or want to change advisors for any reason, see Dr. Canfield.

Many students take additional courses beyond the 133 credits required for graduation due to situations such as failure to satisfy a given CLE area or taking a course on a P/F or Audit basis that 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 résumé, 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. Ms. Madhu Kapania is the department's Co-op advisor. Co-op is an excellent way to gain valuable "real world" experience, earn extra money and line up a job upon graduation. Interested students should begin by contacting the Career Services Office.

COURSE WITHDRAWAL POLICY: You may withdraw from a course without academic penalty up until the last day of class. You can only do this for three courses 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 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. A double major only receives a diploma with the primary major listed, 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 Master's 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 133 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 CLE 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 that 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 fewer 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 CLE 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 may 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.***

THE SENIOR DESIGN COURSE: The capstone design course sequence has three different course options: AOE 4065-66 Aircraft Design, 4165-66 Spacecraft Design, and AOE 4265-66 Ship design. Aerospace Engineering majors choose between Aircraft and Spacecraft Design. Ocean Engineering majors must take Ship Design. Students will have to complete all the prerequisite courses in the junior year of the applicable curriculum to enroll in the design sequences. Note that AOE 4165 Spacecraft Design 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 the fall of the junior year and must take AOE 4140 instead of AOE 3134 in the spring of the junior year. Students wishing to take Aircraft Design must take AOE 3134 in the spring of the junior year.

TECHNICAL 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. Patil and Woolsey are the AIAA Faculty Advisors.

SNAME/ASNE The Society of Naval Architects and Marine Engineers and American Society of Naval Engineers are 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. Seidel is the faculty advisor.

COLLEGE OF ENGINEERING

DEPARTMENT OF AEROSPACE AND OCEAN ENGINEERING

BACHELOR OF SCIENCE IN AEROSPACE AND OCEAN ENGINEERING , MAJOR: AEROSPACE ENGINEERING

FOR STUDENTS GRADUATING IN CALENDAR YEAR 2017

133 CREDITS REQUIRED FOR GRADUATION

FRESHMAN FALL SEMESTER 2013	Credits	FRESHMAN SPRING SEMESTER 2014	Credits
CHEM 1035 General Chemistry **(C–)** *Pre: None*	3	ENGL 1106 First-Year Writing *Pre: ENGL 1105*	3
CHEM 1045 General Chemistry Lab *Co: CHEM 1035*	1		
ENGL 1105 First-Year Writing *Pre: None*	3	MATH 1206 Calculus *Pre: MATH 1205*	3
MATH 1114 Elementary Linear Algebra	2	MATH 1224 Vector Geometry *Pre: MATH 1205 or MATH 1225. Co: MATH 1206*	2
MATH 1205 Calculus *Pre: Math Ready*	3	PHYS 2305 Found of Physics I w/lab **(C–)** *Pre: MATH 1205; Co: MATH 1206*	4
ENGE 1024 Engineering Exploration **(C–)** *Co: MATH 1205*	2	ENGE 1114 Exploration Engineering Design **(C–)** *Pre: ENGE 1024*	2
CLE (Area 2, 3, or 7)	3	CLE (Area 2, 3, or 7)	3
TOTAL	**17**	**TOTAL**	**17**

SOPHOMORE FALL SEMESTER 2014	Credits	SOPHOMORE SPRING SEMESTER 2015	Credits
ESM 2104 Statics **(C–)** *Co: MATH 2114, MATH 2204*	3	ESM 2204 Mech of Deformable Bodies **(C–)** *Pre: ESM 2104, MATH 2204*	3
MATH 2224 Multivariable Calculus **(C–)** *Pre: MATH 1266, MATH 1224*	3	ESM 2304 Dynamics **(C–)** *Pre: ESM 2104, MATH 2204; Co: MATH 2214*	3
PHYS 2306 Foundations of Physics I w/lab *Pre: MATH 1226, PHYS 2305*	4	MATH 2214 Differential Equations **(C–)** *Pre: MATH 1226, MATH 2114*	3
AOE 2074 Computational Methods **(C–)** *Pre: ENGE 1114*	3	AOE 3094 Matrl's for Aero & Ocean Eng *Pre: CHEM 1035; Co: ESM 2204, PHYS 2305*	3 [S,SI]
AOE 2104 Intro to AE **(C–)** *Pre: ENGE 1114, PHYS 2305*	3 [F,SI]	AOE 3104 Aircraft Performance **(C–)** *Pre: 2104, ESM 2104; Co: 2074*	3 [S,SII]
CLE (Area 6)	1	CLE (Area 3, ECON 2005)	3
TOTAL	**17**	**TOTAL**	**18**

JUNIOR FALL SEMESTER 2015	Credits	JUNIOR SPRING SEMESTER 2016	Credits
MATH 4564 Operational Methods **(C–)** *Pre: MATH 2214*	3	MATH Elective *Choice of: MATH 4574, MATH 4404, or STAT 4705*	3
ME 3134 Fund of Thermodynamics **(C–)** *Pre: MATH 2214*	3	AOE 3054 AOE Experimental Methods **(C–)** *Pre: 3014, 3024, and 3034*	3
AOE 3014 Aero/Hydrodynamics **(C–)** *Pre: 3104 or 3204, ESM 2304*	3	AOE 3114 Compressible Aerodynamics **(C–)** *Pre: 3014, ME 3134*	3
AOE 3024 Thin-Walled Structures **(C–)** *Pre: ESM 2104, ESM 2204*	3	AOE 3124 Aerospace Structures **(C–)** *Pre: 3024*	3
AOE 3034 Vehicle Vibration & Control **(C–)** *Pre: ESM 2304, MATH 2214*	3	**Choose one:** AOE 3134 Stability Control **(C–)** *Pre: 3034* AOE 4140 Spacecraft Dyn & Controls **(C–)** *Pre: 3034, 4134*	3
AOE 4134 Astromechanics **(C–)** *Pre: ESM 2304*	3	Technical Elective	3
TOTAL	**18**	**TOTAL**	**18**

SENIOR FALL SEMESTER 2016	Credits	SENIOR SPRING SEMESTER 2017	Credits
AOE 3044 Boundary Layer Theory *Pre: 3014, MATH 4564, ME 3134*	3	AOE 4066 Aircraft Design **or** AOE 4166 Spacecraft Design *Pre: AOE 4x65*	3
AOE 4065 Aircraft Design **(C–) or** AOE 4165 Spacecraft Design **(C–)** *Pre: 3054,3114, 3124, 3134*	3	Technical Elective	3
AOE 4154 Aero Engr Lab *Pre: 3054, 3114, 3124, 3134 or 4140*	1	CLE (Area 2, 3, or 7)	3
AOE 4234 Aerospace Propulsion Systems *Pre: 3114, ME 3134*	3	Elective	3
Technical Elective	3		
CLE (Area 2, 3, or 7)	3		
TOTAL	**16**	**TOTAL**	**12**

Superscripted annotation in Credits column indicates that a course is known to be offered in terms other than when shown. Course offerings are subject to change and the availability of sufficient resources. Students should confirm course offerings in advance with their department. Core courses common to all AOE majors are listed in black. Major courses are listed in blue. AE primary majors with an OE secondary major may substitute 2104 for 2204 and 4065-4066 or 4165-4166 for 4265-4266 in their secondary OE major.

Curriculum for Liberal Education (CLE)

Consult the CLE Alphabetical Listing at: http://www.cle.prov.vt.edu/guides/alpha.html, CLE courses need to be completed prior to graduation. If a CLE course is double-counted to satisfy two different CLE areas, a free elective(s) must be taken to maintain a minimum of 133 credits.

CLE Area 1: Writing and Discourse (6 hrs)	**ENGL 1105**	**(3)**	**ENGL 1106**	**(3)**
CLE Area 2: Ideas, Cultural Traditions, Values Electives (6 hrs)		**(3)**		**(3)**
CLE Area 3: Society & Human Behavior electives (6 hrs)	**ECON 2005**	**(3)**		**(3)**
CLE Area 4: Scientific Reasoning and Discovery (8 hrs)	**CHEM 1035/1045**	**(4)**	**PHYS 2305**	**(4)**
CLE Area 5: Quantitative and Symbolic Reasoning (6 hrs)	**MATH 1205**	**(3)**	**MATH 1206**	**(3)**
CLE Area 6: Creativity & Aesthetic Experience elective (1 hr)				**(1)**
CLE Area 7: Global Issues Elective (3 hrs)				**(3)**

Technical Electives: The AOE department requires 9 credits of technical electives, of which 6 credits must be AOE 3000-level or higher courses and the remaining 3 may be selected from the attached list of computer programming courses and other 3000-level or higher, approved technical courses.

Change of Major Requirements: In order to enter this restricted major, students must have: 1) Minimum 2.0 overall Virginia Tech GPA, 2) Minimum grade of C– or better in ENGE 1024 and ENGE 1114; 3) Minimum grade of D– or better in CHEM 1035, CHEM 1045, ENGL 1105, ENGL 1106, MATH 1205, MATH 1206, MATH 1224 and PHYS 2305. NOTE: Students that have completed all of the required coursework and have a 3.0 or higher Virginia Tech GPA are guaranteed this major. Change of Major applications are accepted prior to the beginning of fall, spring, and summer at: http://www.enge.vt.edu/undergraduate/undergraduate-changing-majors

Foreign Language Requirements: Students must have had 2 years of a foreign language in high school or one year at the college level (6 credit hours) of the same language. College-level credits used to meet this requirement do not count towards the degree.

Satisfactory Progress Towards Degree: University Policy 91 outlines university-wide minimum criteria to determine if students are making satisfactory progress towards the completion of their degrees. The AOE Department fully supports this policy. Specific expectations for satisfactory progress for AE majors are as follows:

- Each student must meet the minimum University-wide criteria as described in Policy 91 and summarized in the Undergraduate Catalog (under Academic Policies)
- After attempting 68 credit hours, students must have passed AOE 2074 and 3104
- Students must maintain 2.0 in-major and overall GPA.
  (The in-major GPA consists of all courses taken under the AOE designation).

Prerequisites: Prerequisites for each course are listed after the course title. All AOE courses require a C– or better for prerequisite courses. There are no hidden pre-requisites in this program of study. Prerequisites may change from what is indicated. Be sure to consult the University Catalog or check with your advisor for most current requirements.

Graduation Requirements: Students must pass all required courses and both the in-major and overall GPA must be at least 2.0 or graduation. Only free electives and courses only offered on a Pass/Fail basis may be taken Pass/Fail. Courses on the College of Engineering list of non-degree credit may not be taken for credit towards graduation (list found at www.eng.vt.edu/forms)

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DEPARTMENT OF AEROSPACE AND OCEAN ENGINEERING

BACHELOR OF SCIENCE IN AEROSPACE AND OCEAN ENGINEERING, MAJOR: OCEAN ENGINEERING

FOR STUDENTS GRADUATING IN CALENDAR YEAR 2017

133 CREDITS REQUIRED FOR GRADUATION

FRESHMAN FALL SEMESTER 2013	Credits	FRESHMAN SPRING SEMESTER 2014	Credits
CHEM 1035 General Chemistry **(C–)** *Pre: None*	3	ENGL 1106 First-Year Writing *Pre: ENGL 1105*	3
CHEM 1045 General Chemistry Lab *Co: CHEM 1035*	1		
ENGL 1105 First-Year Writing *Pre: None*	3	MATH 1206 Calculus *Pre: MATH 1205*	3
MATH 1114 Elementary Linear Algebra	2	MATH 1224 Vector Geometry *Pre: MATH 1205 or MATH 1225. Co: MATH 1206*	2
MATH 1205 Calculus *Pre: Math Ready*	3	PHYS 2305 Found of Physics I w/lab **(C–)** *Pre: MATH 1205; Co: MATH 1206*	4
ENGE 1024 Engineering Exploration **(C–)** *Co: MATH 1205*	2	ENGE 1114 Exploration Engineering Design **(C–)** *Pre: ENGE 1024*	2
CLE (Area 2, 3, or 7)	3	CLE (Area 2, 3, or 7)	3
TOTAL	**17**	**TOTAL**	**17**

SOPHOMORE FALL SEMESTER 2014	Credits	SOPHOMORE SPRING SEMESTER 2015	Credits
ESM 2104 Statics **(C–)** *Co: MATH 2114, MATH 2204*	3	ESM 2204 Mech of Deformable Bodies **(C–)** *Pre: ESM 2104, MATH 2204*	3
MATH 2224 Multivariable Calculus **(C–)** *Pre: MATH 1266, MATH 1224*	3	ESM 2304 Dynamics **(C–)** *Pre: ESM 2104, MATH 2204; Co: MATH 2214*	3
PHYS 2306 Foundations of Physics I w/lab *Pre: MATH 1226, PHYS 2305*	4	MATH 2214 Differential Equations **(C–)** *Pre: MATH 1226, MATH 2114*	3
AOE 2074 Computational Methods **(C–)** *Pre: ENGE 1216*	3	AOE 3094 Matrl's for Aero & Ocean Eng *Pre: CHEM 1035; Co: ESM 2204, PHYS 2305*	3 [S,SI]
AOE 2204 Intro to OE **(C–)** *Pre: ENGE 1114 (C–), PHYS 2305 (C–)*	3 [F,SI]	AOE 3204 Naval Architecture **(C–)** *Pre: 2204, ESM 2104, MATH 2204; Co: 2074*	3 [S,SII]
CLE (Area 6)	1	CLE (Area 3, ECON 2005)	3
TOTAL	**17**	**TOTAL**	**18**

JUNIOR FALL SEMESTER 2015	Credits	JUNIOR SPRING SEMESTER 2016	Credits
MATH 4564 Operational Methods **(C–)** *Pre: MATH 2214*	3	STAT 4705 Probability & Stat for Engr *Pre: MATH 2204*	3
ME 3134 Fund of Thermodynamics **(C–)** *Pre: MATH 2214*	3	AOE 3054 AOE Experimental Methods **(C–)** *Pre: 3014, 3024, and 3034*	3
AOE 3014 Aero/Hydrodynamics **(C–)** *Pre: 3104 or 3204, ESM 2304*	3	AOE 3224 Ocean Structures **(C–)** *Pre: 3024*	3
AOE 3024 Thin-Walled Structures **(C–)** *Pre: ESM 2104, ESM 2204*	3	AOE 3264 Resist & Prop of Ships **(C–)** *Pre: 3014, 3204*	3
AOE 3034 Vehicle Vibration & Control **(C–)** *Pre: ESM 2304, MATH 2214*	3	AOE 4214 Ocean Wave Mechanics **(C–)** *Pre: 3014, MATH 4564*	3
Technical Elective	3	AOE 4244 Marine Engineering **(C–)** *Pre: 3204; (ME 3134 or ME 3124)*	3
TOTAL	**18**	**TOTAL**	**18**

SENIOR FALL SEMESTER 2016	Credits	SENIOR SPRING SEMESTER 2017	Credits
AOE 3044 Boundary Layer Theory *Pre: 3014, MATH 4564, ME 3134*	3	AOE 4266 Ship Design *Pre: 4265*	3
AOE 4265 Ship Design **(C–)** *Pre: 3054, 3224, 3264, 4214, 4244; Co: 4334*	3	CLE (Area 2, 3, or 7)	6
AOE 4254 Ocean Engr Lab *Pre: 3054, 3264*	1	Technical Elective	3
AOE 4334 Ship Dynamics *Pre: 3014, 3034, 4214; MATH 4564*	3	Elective	3
Technical Elective	3		
TOTAL	**13**	**TOTAL**	**15**

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CLE Area 1: Writing and Discourse (6 hrs)	**ENGL 1105**	**(3)**	**ENGL 1106**	**(3)**
CLE Area 2: Ideas, Cultural Traditions, Values Electives (6 hrs)		**(3)**		**(3)**
CLE Area 3: Society & Human Behavior electives (6 hrs)	**ECON 2005**	**(3)**		**(3)**
CLE Area 4: Scientific Reasoning and Discovery (8 hrs)	**PHYS 2305**	**(4)**	**PHYS 2306**	**(4)**
CLE Area 5: Quantitative and Symbolic Reasoning (6 hrs)	**MATH 1205**	**(3)**	**MATH 1206**	**(3)**
CLE Area 6: Creativity & Aesthetic Experience elective (1 hr)				**(1)**
CLE Area 7: Global Issues Elective (3 hrs)				**(3)**

Technical Electives: The AOE department requires 9 credits of technical electives, of which 6 credits must be AOE 3000-level or higher courses and the remaining 3 may be selected from the attached list of computer programming courses and other 3000-level or higher, approved technical courses.

Change of Major Requirements: In order to enter this restricted major, students must have: 1) Minimum 2.0 overall Virginia Tech GPA, 2) Minimum grade of C- or better in ENGE 1024 and ENGE 1114; 3) Minimum grade of D- or better in CHEM 1035, CHEM 1045, ENGL 1105, ENGL 1106, MATH 1205, MATH 1206, MATH 1224 and PHYS 2305. NOTE: Students that have completed all of the required coursework and have a 3.0 or higher Virginia Tech GPA are guaranteed this major. Change of Major applications are accepted prior to the beginning of fall, spring, and summer at: http://www.enge.vt.edu/undergraduate/undergraduate-changing-majors

Foreign Language Requirements: Students must have had 2 years of a foreign language in high school or one year at the college level (6 credit hours) of the same language. College-level credits used to meet this requirement do not count towards the degree.

Satisfactory Progress Towards Degree: University Policy 91 outlines university-wide minimum criteria to determine if students are making satisfactory progress towards the completion of their degrees. The AOE Department fully supports this policy. Specific expectations for satisfactory progress for Ocean Engineering majors are as follows:

- Each student must meet the minimum University-wide criteria as described in Policy 91 and summarized in the Undergraduate Catalog (under Academic Policies).
- After attempting 68 credit hours, students must have passed AOE 2074 and 3204.
- Students must maintain 2.0 overall and in-major GPAs.
  (The in-major GPA consists of all courses taken under the AOE designation).

Prerequisites: Prerequisites for each course are listed after the course title. All AOE courses require a C– or better for prerequisite courses. There are no hidden pre-requisites in this program of study. Prerequisites may change from what is indicated. Be sure to consult the University Catalog or check with your advisor for most current requirements.

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CLE Area 7: Global Issues Elective (3 hrs)				**(3)**

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- Students must maintain 2.0 overall and in-major GPAs.
  (The in-major GPA consists of all courses taken under the AOE designation).

Prerequisites: Prerequisites for each course are listed after the course title. All AOE courses require a C– or better for prerequisite courses. There are no hidden pre-requisites in this program of study. Prerequisites may change from what is indicated. Be sure to consult the University Catalog or check with your advisor for most current requirements.

Graduation Requirements: Students must pass all required courses and both the in-major and overall GPA must be at least 2.0 or graduation. Only free electives and courses only offered on a Pass/Fail basis may be taken Pass/Fail. Courses on the College of Engineering list of non-degree credit may not be taken for credit towards graduation (list found at www.eng.vt.edu/forms)

VirginiaTech
College of Engineering

Academic Affairs
212 Hancock Hall (0275)
Blacksburg, Virginia 24061
540/231-3244 Fax: 540/231-1831
E-mail: engris@vt.edu
http://www.eng.vt.edu/overview/acad_affairs.php

To: Engineering Undergraduates
From: Bevlee Watford, Associate Dean, Academic Affairs
Subject: Non-degree credit

DATE: October 2011

Please be aware that not all courses 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 not exhaustive, so if you have any questions, you should check with your engineering department about additional non-credit courses. This list is updated periodically. Be sure to review the list each semester at: http://www.eng.vt.edu/overview/acad_affairs_whatwedo.php

CS 1004 (Computer Literacy), (no credit awarded to CS majors for these courses: CS 4004, 4014)

UNIV or EDCI 1004 (College Success Strategies), 1014 (Cadet Success Seminar), 1704 (First Year Seminar Course), 2004 (Exploring Careers), 4974 (Independent Study), 2984 (Special Study: Any Subtitle), 4984 (Special Study: Any Subtitle)

EF/ENGE 2984 (Engineering Success Seminar)

ENGL 1004, 0014 (English as a Second Language)

ENGR 3004 Mentoring Seminar; ENGR 4984 (CEED Team Leader Seminar)

ESM 2984 (ESP Statics, Prof Dev Sem for ESM), ESM 4404 (Fundamentals of Professional Engineering)

FCD 2984 (Success Project)

HD 2984 (Healthy Living, Success Project)

MaSc 1024, 1025, 1026 (Mathematics, A Liberal Arts Approach), 1034 (Statistics, A Liberal Arts Approach), 1044 (Computer Science, A Liberal Arts Approach)

MATH 1504 (PreCalc), 2984 (Emerging Scholar), 1015 (Elem Calc with Trig. CS majors may receive 1015 credit if taken before 1205), 1016 (Elementary Calc with Trig), 1525-1526 (Elementary Calc with Matrices), 2015-2016 (Elementary Calc with Trig II)

ME 4984 (SAE Automotive Essentials)

PHYS 2205-2206 (General Physics, not Calc-based)

PSYC 2984 (First Year Experience, Athletic Transitions)

AOE DEPARTMENT ELECTIVE POLICIES AND REQUIREMENTS
For students graduating in calendar year 2017

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 requirements. 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 4x65 and 4x66) in the major.

MATH ELECTIVE: All AE students must take 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 may fill all technical elective requirements with required courses from their second major. Courses other than those below may be acceptable as technical electives; however, AOE must approve any substitutions ***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
CHEM:	4615
CS:	1044, 1054, 1064, 1114, 1124
ECE:	3054, 4164, 4405, 4406, 4624, 4634, 4644
ENGE:	2514 (2cr)
ENGR:	3124
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 math elective)
ME:	4204, 4224, 4254, 4504, 4514, 4524, 4534, 4634, 4644, 4704, 4724, 4734
NSEG:	3145, 3146
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 may be used as free elective credits. Free electives may be taken on 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
1st 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
1st 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
2nd Yr Fall			
	AOE/ESM 2074 Comp Methods	ENGE 1114, Co: MATH 2224	Co: AOE 3104, 3204
(AE)	AOE 2104 Intro to Aerospace Engr	ENGE 1114, PHYS 2305	AOE 3104, 3204
(OE)	AOE 2204 Intro to Ocean Engr	ENGE 1114, PHYS 2305	AOE 3104, 3204
	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	
2nd Yr Spring			
	AOE 3094 AOE Materials	CHEM 1035,Co: ESM 2204, PHYS 2305	
(AE)	AOE 3104 Aircraft Performance	AOE 2104 or 2204; ESM 2104, Co: 2074, ESM 2304	All 3000 & higher level AOE courses
(OE)	AOE 3204 Naval Architecture	AOE 2104 or 2204; ESM 2104, MATH 2224, Co: 2074, 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
3rd 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 2104, 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
3rd Yr Spring			
	AOE 3054 Exp. Methods	AOE 3014, 3024, 3034	AOE 4154, 4254, 4x65
(AE)	AOE 3114 Compressible Aerodyn	AOE 3014, ME 3134	AOE 4154, 4234, 4065, 4165
(AE)	AOE 3124 A/C Structures	AOE 3024	AOE 4154, 4065, 4165
(AE)	AOE 3134 Stability & Control	AOE 3034	AOE 4154, 4065
(OE)	AOE 3224 Ocean Structures	AOE 3024	AOE 4265
(OE)	AOE 3264 Resist & Propulsion	AOE 3014, 3204	AOE 4254, 4265
(AE)	AOE 4140 Spacecraft Dynamics & Control	AOE 3034, 4134	AOE 4165, 4154
(OE)	AOE 4214 Ocean Wave Mechanics	AOE 3014, MATH 4564	AOE 4334, 4265
(OE)	AOE 4244 Marine Engineering	AOE 3204, ME 3124 or 3134	AOE 4265
(OE)	STAT 4705 Prob & Statistics For Engr	MATH 2224	
4th Yr Fall			
	AOE 3044 Boundary Layer & Heat Transfer	AOE 3014, MATH 4564, ME 3134	
(AE)	AOE 4065 Aircraft Design I	AOE 3054, 3114, 3124, 3134	AOE 4066
(AE)	AOE 4165 Spacecraft Design I	AOE 3054, 3114, 3124, 4140	AOE 4166
(OE)	AOE 4265 Ship Design I	AOE 3054, 3224, 3264, 4214, 4244; Co: AOE 4334	AOE 4266
(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	AOE 4265
4th Yr Spring			
(AE)	AOE 4066 Aircraft Design II	AOE 4065	
(AE)	AOE 4166 Spacecraft Design II	AOE 4165	
(OE)	AOE 4266 Ship Design II	AOE 4265	

AOE ELECTIVE CHECK SHEET

AE and OE majors are required to take 31 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's CLE courses 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 a computer programming elective or 3000 level or higher courses in or out of AOE from the AOE Technical Elective List.*

AOE Technical Electives: _____, _____ **6 cr**

Other Tech. Electives: _____ **3 cr**

NOTE: AOE students pursuing a double major will use required courses from their second major to fill the above elective slots. Also if you take 'ENGE 2314 or 2514' as technical elective, you need to find another one credit hour of tech technical elective to complete 9 credit hours of technical electives.

MATH ELECTIVE: *MATH 4574, AOE 4404, OR STAT 4705*
(STAT 4705 is required for Ocean Engineering majors) _____ **3 cr**

CORE AND FREE ELECTIVES:

Area 2: _____, _____ **6 cr**
Area 3: (include Econ 2005 or add ISE 2014 as extra requirement) _____, _____ **6 cr**
Area 6: (one credit required, excess credits should be listed as "free" elective) _____ **1 cr**

Area 7 or "Free" Elective _____ **3 cr**
(This space can be filled with a "free" elective if an Area 7 course was used in Areas 2 or 3)

"Free" Electives _____, _____ **3 cr**

(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.)*

TOTAL ELECTIVES _____
31 cr

Note that "double counting" Area 2 or 3 courses for Area 7 only satisfies the CLE. **You will still need a minimum of 133 credit hours to graduate.** You may need to take additional free elective hours. There are no double count courses in Area 6.

MINOR IN NAVAL ENGINEERING (NAVE)

Department of Aerospace and Ocean Engineering

College of Engineering

Check sheet for students graduating in calendar year 2018

Naval Engineering is defined as a field of study and expertise that includes all engineering and sciences as applied in the research, development, design, construction, operation, maintenance and logistic support of surface and subsurface ships, craft, aircraft, and vehicles (manned and autonomous) used by the Navy for the Nation's defense. It inherently includes multiple engineering disciplines, and hence it is open to all students in the College of Engineering who meet the following requirements.

A minor in Naval Engineering consists of not less than 18 semester credit hours. For successful completion of the Minor, students must maintain a 2.0 in-Minor GPA with a minimum grade of C– or better in all courses that the student counts towards the minor.

Required:			
AOE	**2204**	**Introduction to Ocean Engineering**	
or AOE	**3204**	**Naval Architecture**	**3**
AOE	**4264**	**Principles of Naval Engineering (NAVE1)**	**3**
AOE	**4994**	**Undergraduate Research**	
or xxx	**4994**	**Undergraduate Research with approved NE focus**	**3**
		Total Credits from Required Courses	**9**
		Credits Remaining from Below	**9**
		Total Required Credits	**18**

Choose a minimum of nine credit hours from the following courses. The broad range and large number of these courses reflects the multiple engineering disciplines inherent in Naval Engineering.

XXX	**4xxx**	**Capstone Design Course with approved NE focus; SE, Team and Project Mgmt components**	**6**
XXX	**4994**	**Undergraduate Research w/NE focus (6 w/above)**	**3**
AOE	**3204**	**Naval Architecture**	**3**
AOE	**4244**	**Marine Engineering****	**3**
AOE	**5314**	**Naval Ship System Design (NAVE2)**	**3**
AOE	**3264**	**Resistance and Propulsion of Ships ****	**3**
AOE	**3104**	**Aircraft Performance****	**3**
AOE	**3134**	**Stability and Control****	**3**
AOE	**4234**	**Aerospace Propulsion Systems****	**3**
AOE	**4140**	**Spacecraft Dynamics and Control****	**3**
CHE	**2164**	**Chemical Engineering Thermodynamics**	**3**
CHE	**3044**	**Heat Transfer**	**2**
CHE	**3184**	**Chemical Reactor Analysis and Design****	**3**
CHE	**4134**	**Chemical Process Modeling****	**2**
CEE	**3104**	**Introduction to Environmental Engineering**	**3**
CS	**3724**	**Introduction to Human-Computer Interaction****	**3**
CS	**3114**	**Data Structures and Algorithms****	**3**
CS	**3204**	**Operating Systems****	**3**
CS	**3304**	**Comparative Languages****	**3**
ECE	**3054**	**Electrical Theory****	**3**
ECE	**3304**	**Introduction to Power Systems****	**3**
ECE	**4224**	**Power Electronics****	**3**
ECE	**3574**	**Applied Software Engineering****	**3**
ECE	**2704**	**Signals and Systems**	**3**
ECE	**3504**	**Digital Design I****	**4**
ECE	**2500**	**Computer Organization & Architecture**	**3**
ESM	**2204**	**Mechanics of Deformable Bodies**	**3**

ESM	**3015**	**Fluid Mechanics I, II**	**3**
ESM	**3054/3064**	**Mechanical Behavior of Materials**	**3**
ESM	**4044**	**Mechanics of Composite Materials****	**3**
ESM	**4734 (AOE 4024)**	**An Introduction To The Finite Element Method****	**3**
ISE	**3614**	**Intro to Human Factors Engineering**	**3**
ISE	**2014**	**Engineering Economy**	**2**
ISE	**2404**	**Deterministic Operations Research**	**3**
ISE	**3414**	**Probabilistic Operations Research****	**3**
ISE	**3624**	**Industrial Ergonomics**	**3**
ISE	**4005**	**Project Management and System Design****	**3**
ME	**3124**	**Thermodynamics**	**3**
ME	**3304**	**Heat and Mass Transfer**	**3**
ME	**3404**	**Fluid Mechanics**	**3**
ME	**3514**	**System Dynamics**	**3**
ME	**4124**	**CAD of Fluid-Thermal Systems****	**3**
MSE	**4164**	**Principles of Materials Corrosion**	**3**
MSE	**4034**	**Thermodynamics of Materials****	**3**
MSE	**3054/3064**	**Mechanical Behavior of Materials**	**2**
MSE	**4354**	**Strength and Fracture****	**1**

**** Prerequisites may apply – see your advisor**

This minor supports the requirements of the Naval Engineering Education Consortium (NEEC) in which students may also participate. The consortium provides opportunities for industry and US Navy mentors, projects, internships, co-ops and job opportunities.