

Mechanical and Aerospace Engineering

Undergraduate Handbook

1. Introduction

The Mechanical Engineering degree at the department of Mechanical and Aerospace Engineering is accredited by the Engineering Accreditation Commission of ABET, <http://www.abet.org>. The Aerospace Engineering degree is undergoing its first accreditation in Fall 2018.

The Department of Mechanical and Aerospace Engineering offers a standard Mechanical Engineering curriculum leading to a BS degree in Mechanical Engineering, with optional Aerospace Engineering or Energy Systems Concentrations.

Students who select the Aerospace Engineering or Energy Systems concentration (for the ME degree) will be required to include in their departmental electives three courses related to the aerospace or energy fields. Details of the standard ME curriculum and aerospace or energy concentrations are presented in Section II: The MAE Curriculum.

Starting with Class of 2018 the Mechanical and Aerospace Engineering Department offers a BS degree in Aerospace Engineering (specializing in Aeronautics or Astronautics) with an optional Energy Concentration.

Students who select the Energy concentration (for the AE degree) will be required to include in their departmental and technical electives three courses related to the energy field. Details of the standard AE curriculum with the energy concentration are presented in the MAE Curriculum section.

Throughout the Mechanical Engineering and Aerospace Engineering curricula, every effort is made to fulfill the department's educational objectives, namely:

1. To educate and train students in Mechanical Engineering, or in Aerospace Engineering, in a technically sound, challenging and professional manner
2. To prepare students to enter careers ready to make positive contributions to their professions and society, or to continue on to successful graduate research and education
3. To inculcate in students the responsibilities and rewards associated with an engineering career and life-long service to the profession.

Where each student graduating from the Mechanical and Aerospace Engineering program would have demonstrated:

- a) an ability to apply knowledge of mathematics, science, and engineering

- b) 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
- d) and safety, manufacturability, and sustainability
- e) an ability to function on multi-disciplinary teams
- f) an ability to identify, formulate, and solve engineering problems
- g) an understanding of professional and ethical responsibility
- h) an ability to communicate effectively
- i) the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context
- j) a recognition of the need for, and an ability to engage in life-long learning
- k) a knowledge of contemporary issues
- l) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

2. MAE Curriculum

The Department of Mechanical and Aerospace Engineering offers a Mechanical Engineering Curriculum leading to a BS degree in Mechanical Engineering. All Mechanical Engineering Students have a broad selection of Departmental Electives, which can be selected according to the students' interests and career goals. The MAE Department also offers two additional concentrations in Aerospace and Energy Systems.

1. *Standard Mechanical Engineering Curriculum*: Students following this concentration are required to take any 3 Departmental Electives. In addition, students take Mechanical Engineering Laboratories II (14:650:432) in the final spring semester of senior year. Students completing the requirements for this concentration receive a Mechanical Engineering degree/diploma.
 - Aerospace Concentration: Students following this concentration are required to select only Aerospace Electives¹ as Departmental Electives (3 courses). Students completing the requirements for this concentration receive an Aerospace certificate in addition to their Mechanical Engineering Diploma.
 - Energy Systems Concentration: Students following this Concentration are required to select only Energy Systems Electives² as Departmental Electives (3 courses). Students completing the requirements for this concentration receive an Energy Systems certificate in addition to their Mechanical Engineering Diploma.

With the introduction of new mandatory courses certain are necessitated. Students are strongly advised to follow the CURRICULUM PERTINENT TO THEIR YEAR OF GRADUATION. That is, the transition classes graduating in 2018-2019, have the old curriculum, CLASS 2020 has an adjusted curriculum, while the students of CLASS 2021 have the updated Mechanical Engineering Curriculum.

2. *Standard Aerospace Engineering Curriculum*: Students following this concentration are required to take the courses described in the Aerospace Engineering section below FOLLOWING CURRICULUM PERTINENT TO THEIR YEAR OF GRADUATION. That is, the transition classes graduating in 2018, first Aerospace Engineers graduating from Rutgers, and 2019 have adjusted curricula for CLASS 2018 and CLASS 2019, respectively, while the students of CLASS 2020 have the permanent Aerospace Curriculum.

Note that the Aerospace discipline is designated as *Aeronautical Engineering* or *Astronautical Engineering*. The difference is that *Astronautical Engineers* have to take 650:465 Orbital Mechanics as their departmental or technical elective.

Aerospace Engineers may elect to do the Energy Systems concentration in the following manner:

- Energy Systems Concentration: Students following this Concentration are required to select only Energy Systems Electives² as Departmental Elective (1 course) and Technical Electives (2 courses). Students completing the requirements for this concentration receive an Energy Systems certificate in addition to their Mechanical Engineering Diploma.

See course objectives and descriptions for further details on engineering (650) courses.

3. Capstone Design Projects

Design and Manufacturing Project I & II (required for Mechanical Engineering Degree)

All Mechanical Engineering students (650) during the senior year should register for the sequence of two courses: 650:467 Design and Manufacturing Project I (2cr) during Fall Semester and 650:468 Design and Manufacturing Project II (2cr) during Spring Semester. Successful completion of these courses is a graduation requirement.

Fall Registration

Student should select a section from the list of available projects available on the MAE website:

<http://mae.rutgers.edu/capstone-design-project>

Select the project you would like to work on and contact the corresponding Professor. The projects are by SP# only until the end of May. If there are any slot left then they open up to all students.

There is a limit of 5-8 students per section depending on the project. Once the limit is reached the section will be closed. The students in the section will constitute a group that will work together towards the design and manufacturing of the project prototype. If the section of your first preference is closed, please select your subsequent choice.

Spring Registration

Register for the same section as in the Fall semester.

Aerospace Design Project I & II (required for Aerospace Engineering degree)

All Aerospace Engineering students (021) during the senior year should register for the sequence of two courses: 650:487 Aerospace Design Project I (2cr) during Fall Semester and 650:488 Aerospace Design Project II (2cr) during Spring Semester. Successful completion of these courses is a graduation requirement.

Fall Registration

Student should select a section from the list of available projects available on the MAE website:

<http://mae.rutgers.edu/aerospace-design-project>

Select the project you would like to work on and contact the corresponding Professor. The projects are by SP# only until the end of May. If there are any slot left then they open up to all students.

There is a limit of 5-8 students per section depending on the project. Once the limit is reached the section will be closed. The students in the section will constitute a group that will work together towards the design and manufacturing of the project prototype. If the section of your first preference is closed, please select your subsequent choice.

Spring Registration

Register for the same section as in the Fall semester.

Guidelines for Design and Manufacturing or Aerospace Design

Description

The culmination of every Rutgers MAE student's undergraduate academic career is the yearly Design Project. All that classroom learning gets put to real-life use as small groups work under one of our faculty members to design and build a device to accomplish a preset list of goals. Students present their projects in April of each year close to or on Rutgers Day. Past projects have included a mechanical fish, unmanned aerial, ground, and naval vehicles, and so much more.

During their projects, students have the opportunity to work with industry members as well as our faculty, gaining experience in real-world engineering. Many of these projects can lead to new technologies or other innovations outside of academia and they help our students transition to life after graduation.

Duration

Design and Manufacturing is a yearlong project, Fall 650:467 (ME) or 650:487 (AE) and Spring 650:468 (ME) or 650:488 (AE). In the fall semester, the students will design and budget the project while in the spring semester they will build a working prototype. THE AEROSPACE DESIGN PROJECTS CAN HAVE ONLY AEROSPACE ENG (021) STUDENTS.

Team building

Each team is composed of five (5) MAE students (larger teams can be formed upon discussion with the faculty) and one MAE faculty member.

A group of students may form a team and target a specific project that they like or each student may register to one of the open (no special permission number, SP#, required) projects found on the website <http://mae.rutgers.edu/capstone-design-project>

Students and advisor from other departments may join the teams upon agreement of all team members and advisors. Non-MAE student(s) will be added to the group of 5 MAE students and they may register either in the 650: 299/399/499 course(s) or can register in their department's senior design/undergraduate research course(s).

Projects

Each faculty has project(s) that are posted on our website by the end of the second week of April. The students should select one of those projects. There are instances that the faculty and students have made arrangements prior to the spring break for certain ideas they have that they want translated to projects. These can be included in the program if the projects are finalized by the end of the spring break of Junior year so they can be cited in the website.

Registration

The faculty may request a project to be by special permission only at which instance the students will have to make arrangements and meet the faculty before they register. Alternatively, the project will be open and then the students can register on a first-come-first-serve basis.

Your advisor should have the special permission numbers (SP#) for your group and he/she will assign them to you after you discuss the project with him/her.

Project registration begins in May of Junior year and should be completed by end of June of Junior year.

4. Electives for Mechanical Engineers: Departmental, Technical, Humanities/Social Science, General

- A. Departmental Electives are all 3-credit ,400 level mechanical engineering (650:xxx) courses that are not already required in the curriculum. Students must take 3 Departmental Electives. (Aerospace Electives¹, Energy Electives²)

Fall Electives (Annual)

- 401 - System Dynamics and Controls*
- 451 - Vehicle Dynamics (***Bi-Annual Odd Years***)
- 455 - Design of Mechanisms
- 462 - Power Plants²
- 465 - Orbital Mechanics¹
- 447 - Probabilistic Models in ME and AE Systems (***Bi-Annual Even Years***)¹
- 474 - Alternative Energy I²

Spring Electives (Annual)

- 401 - System Dynamics and Controls*
(note: CLASSES 2018-2019 this course was called Mechanical Control Systems)
- 449 - Aerospace Materials
(note: CLASSES 2018-2019 this course was called Intro to Comp Materials)
- 458 - Aerospace Structures¹
- 459 - Aerospace Propulsion¹
- 460 - Aerodynamics¹
- 461 - Internal Combustion Engines²
- 463 - Compressible Fluid Dynamics¹
- 471 - Aircraft Flight Dynamics Structures¹
- 478 - ME Aspects of Electronic Packaging
- 477 - Alternative Energy II²

Legend

- * This course is offered both semesters (Fall and Spring)
- ¹ This course may be used for the Aerospace Concentration
- ² This course may be used for the Energy Concentration

All above courses can be mixed for the Mechanical Engineering degree if you decide not to do a concentration.

- B. Technical Electives are those upper level technical courses appropriate for mechanical engineers. The MAE curriculum requires two (2) technical electives to be chosen from the list on page 14 of this booklet. Any extra departmental electives course may be used as a technical elective. A student may take Undergraduate Research (650:299/399/499), Internship Experience (650:495), or Co-Op Experience (650:496/497), as technical electives with approval of a professor supervising the work, for up to 6 credits (see limitations and application procedure in Section 4 Professional and Supplemental Programs of this document.)

- C. Humanities/Social Science Electives are intended to serve the objectives of a broad education, and to make engineers fully aware of their social responsibilities and better able to consider related factors in the decision-making process. A list of acceptable Humanities/Social Science Electives courses is provided on the School of Engineering website at <http://soe.rutgers.edu/electives>.

- D. General Electives may be almost any course taught for credit at Rutgers University qualifies as a general elective. There are, however, a few exceptions in certain subject areas. See the School of Engineering website for details <http://soe.rutgers.edu/electives>.

Course descriptions for MAE courses as well as courses on Sciences, Humanities, and Math can be found at the pertinent Rutgers Course Catalogues. For example, MAE course descriptions are found at

http://catalogs.rutgers.edu/generated/nb-ug_0507/pg21489.html

MECHANICAL ENGINEERING CURRICULUM FOR CLASS 2018-2019

Freshman Year

160:159	Gen Chem for Engrs	3	160:160	Gen Chem for Engrs	3
160:171	Intro Experimentation	1	440:127	Intro Computers for Engrs	3
355:101	Expository Writing	3	640:152	Calculus for Eng'g	4
440:100	Intro to Engineering	1	440:221*	Eng'g Mech (Statics)	3
640:151	Calculus for Eng'g	4	750:124	Analytical Physics Ib	2
750:123	Analytical Physics Ia	2	_____	Hum/Soc Elective	3
_____	Hum/Soc Elective	3			

Sophomore Year

640:251	Multivariable Calculus	4	332:373*	Elem. of Elect. Eng'g	3M
650:231*	ME Comp Anal& Des.	3M	332:375*	Elem Elect Eng'g Lab	1M
440:222*	Eng'g Mech (Dynamics)	3	650:215*	Bas Comptr Aid Draft	1M
750:227	Analyt Physics IIa	3	640:244	Differential Equations	4
750:229	Analyt Physics IIa Lab	1	650:291*	Mech. Materials	3M
_____	Hum/Soc Elective (200+)	3	750:228	Analyt Physics IIb	3
			750:230	Analyt Physics IIb lab	1

Concentrations: Aerospace Energy

Junior Year

540:343	Engineering Econ	3M	635:407	Mech. Prop. Materials	3M
640:421	Advanced Calculus	3M	650:342*	Design Mech Components	3M
650:312*	Fluid Mechanics	3M	650:351*	Thermodynamics	3M
650:350*	ME Measurements	4M	650:388*	CAD in Mech Eng'g	3M
_____	Hum/Soc Elective (200+)	3	220:102	MicroEconomics	3

Senior Year

650:431	ME Lab I	2M	650:432/3/5	ME/Aero/Energy Lab II	2M
650:467	Engineering Projects I	2M	650:468	Engineering Projects II	2M
650:481*	Heat Transfer	3M	650:443*	Vibrations	3M
650:4XX	Dept/Aero/Energy Elec	3M	650: 4XX	Dept/Aero/Energy Elec	3M
650:4XX	Dept/Aero/Energy Elec	3M	_____	Technical Elective	3
_____	Technical Elective	3	_____	General Elective	3

- The MAE courses marked with (*) above can be taken either fall or spring semester
- All MAE Departmental Electives can count for Technical Electives

Aerospace Dept Concentration Courses

650:401	System Dynamics & Controls; cf pg 6
650:447	Prob Models in AE Systems
650:449	Aerospace Materials; cf pg 6
650:458	Aerospace Structures
650:459	Aerospace Propulsion
650:460	Aerodynamics
650:463	Compressible Fluid Dynamics
650:465	Orbital Mechanics
650:471	Aircraft Flight Dynamics

Energy Dept Concentration Courses

650:461	Internal Combustion Engines
650:462	Power Plants
650:474	Alternative Energy I
650:477	Alternative Energy II

Dept Electives (No Concentration)

650:451	Vehicle Dynamics
650:455	Design of Mechanisms
650:478	ME Aspects Elec Packg
650:439	Multiphysics Simulations

+ any elective from Aero/Energy classes

MECHANICAL ENGINEERING CURRICULUM FOR CLASS 2020

Freshman Year

160:159	Gen Chem for Engrs	3	160:160	Gen Chem for Engrs.	3
160:171	Intro Experimentation	1	440:127	Intro Computers for Engrs	3
355:101	Expository Writing	3	440:221*	Eng'g Mech (Statics)	3
440:100	Intro to Engineering	1	640:152	Calculus for Eng'g	4
640:151	Calculus for Eng'g	4	750:124	Analytical Physics IB	2
750:123	Analytical Physics IA	2	_____	Hum/Soc Elective	3
_____	Hum/Soc Elective	3			

Sophomore Year

640:251	Multivariable Calculus	4	640:244	Differential Equations	4
650:231*	ME Comp Anal& Des	3M	650:215*	Bas Comptr Aid Draft	1M
440:222*	Eng'g Mech (Dynamics)	3	650:291*	Mech Materials	3M
750:227	Analyt Physics IIa	3	650:361*	Mechatronics	4M
750:229	Analyt Physics IIa Lab	1	750:228	Analyt Physics IIB	3
_____	Hum/Soc Elective (200+)	3	750:230	Analyt Physics IIB lab	1

Concentrations: Aerospace Energy

Junior Year

540:343*	Engineering Econ	3M	220:102*	MicroEconomics	3
640:421	Advanced Calculus	3M	635:407	Mech. Prop. Materials	3M
650:312*	Fluid Mechanics	3M	650:342*	Design Mech Component	3M
650:350*	MAE Mes w/Lab	4M	650:351*	Thermodynamics	3M
_____	Hum/Soc Elective (200+)	3	650:388*	CAD in MAE	3M

Senior Year

650:431	Mech/Aero Eng Lab I	2M	650:401*	Sys Dynamics & Controls	3M
650:467	Design & Manufacturing I	2M	650:468	Design & Manufacturing	2M
650:481*	Heat Transfer	3M	650:432/3/5	Mech/Aero/Energy Lab II	2M
_____	Technical Elective	3	650:4XX	Dept/Aero/Energy Elec	3M
650:4XX	Dept/Aero/Energy Elec	3M	_____	Technical Elective	3
650:4XX	Dept/Aero/Energy Elec	3M	_____	General Elective	3

- The MAE courses marked with (*) above can be taken either fall or spring semester
- All MAE Departmental Electives can count for Technical Electives

Aerospace Dept Concentration Courses

650:447	Prob Models in AE Systems
650:449	Aerospace Materials; cf pg 6
650:457	Spacecraft Mission Design
650:458	Aerospace Structures
650:459	Aerospace Propulsion
650:460	Aerodynamics
650:463	Compressible Fluid Dynamics
650:465	Orbital Mechanics
650:471	Aircraft Flight Dynamics

Energy Dept Concentration Courses

650:461	Internal Combustion Engines
650:462	Power Plants
650:474	Alternative Energy I
650:477	Alternative Energy II

Dept Electives (No Concentration)

650:451	Vehicle Dynamics
650:455	Design of Mechanisms
650:478	ME Aspects Elec Packg
650:439	Multiphysics Simulations
650:443	Vibrations

+ any elective from Aero/Energy classes

MECHANICAL ENGINEERING CURRICULUM FOR CLASS 2021+

Freshman Year

160:159	Gen Chem for Engrs	3	160:160	Gen Chem for Engrs	3
160:171	Intro Experimentation	1	440:127	Intro Computers for Engrs	3
355:101	Expository Writing	3	440:221*	Eng'g Mech (Statics)	3
440:100	Intro to Engineering	1	640:152	Calculus for Eng'g	4
640:151	Calculus for Eng'g	4	750:124	Analytical Physics IB	2
750:123	Analytical Physics IA	2	_____	Hum/Soc Elective	3
_____	Hum/Soc Elective	3			

Sophomore Year

440:222*	Eng'g Mech (Dynamics)	3	640:244	Differential Equations	4
640:251	Multivariable Calculus	4	650:215*	Bas Comp Aid Draft	1M
650:388*	CAD in MAE	3 M	650:291*	Mech Materials	3M
750:227	Analyt Physics IIA	3	650:361*	Mechatronics	4M
750:229	Analyt Physics IIA Lab	1	750:228	Analyt Physics IIB	3
_____	Hum/Soc Elective (200+)	3	750:230	Analyt Physics IIB lab	1

Concentrations: Aerospace Energy

Junior Year

540:343	Engineering Econ	3M	220:102	MicroEconomics	3
640:421	Advanced Calculus	3M	635:407	Mech Prop Materials	3M
650:312*	Fluid Mechanics	3M	650:342*	Design Mech Component	3M
650:350*	MAE Mes w/Lab	4M	650:351*	Thermodynamics	3M
_____	Hum/Soc Elective (200+)	3	650:439*	Mutliphysics Simulations	3M

Senior Year

650:431	Mech/Aero Eng Lab I	2M	650:401*	Sys Dynamics & Controls	3M
650:467	Design & Manufacturing I	2M	650:468	Design & Manufacturing	2M
650:481*	Heat Transfer	3M	650:432/3/5	Mech/Aero/Energy Lab II	2M
650:4XX	Dept/Aero/Energy Elec	3M	650:4XX	Dept/Aero/Energy Elec	3M
650:4XX	Dept/Aero/Energy Elec	3M	_____	Technical Elective	3
_____	Technical Elective	3	_____	General Elective	3

- The MAE courses marked with (*) above can be taken either fall or spring semester
- All MAE Departmental Electives can count for Technical Electives

Aerospace Dept Concentration Courses

650:447	Prob Models in AE Systems
650:449	Aerospace Materials
650:457	Spacecraft Mission Design
650:458	Aerospace Structures
650:459	Aerospace Propulsion
650:460	Aerodynamics
650:463	Compressible Fluid Dynamics
650:465	Orbital Mechanics
650:471	Aircraft Flight Dynamics

Energy Dept Concentration Courses

650:461	Internal Combustion Engines
650:462	Power Plants
650:474	Alternative Energy I
650:477	Alternative Energy II

Dept Electives (No Concentration)

650:451	Vehicle Dynamics
650:455	Design of Mechanisms
650:478	ME Aspects Elec Packg
650:443	Vibrations

+ any elective from Aero/Energy classes

AEROSPACE ENGINEERING CURRICULUM FOR **CLASS OF 2018**

Freshman Year

160:159	Gen Chem for Engrs	3	160:160	Gen Chem for Engrs	3
160:171	Intro Experimentation	1	440:127	Intro Computers for Engrs	3
355:101	Expository Writing	3	640:152	Calculus for Eng'g	4
440:100	Intro to Engineering	1	440:221	Eng'g Mech (Statics)	3
640:151	Calculus for Eng'g	4	750:124	Analytical Physics Ib	2
750:123	Analytical Physics Ia	2	_____	Hum/Soc Elective	3
_____	Hum/Soc Elective	3			

Sophomore Year

640:251	Multivariable Calculus	4	332:373	Elem of Elect Eng'g	3
650:231	ME Comp Anal & Des	3M	332:375	Elem Elect Eng'g Lab	1
440:222*	Eng'g Mech (Dynamics)	3	650:215	Bas Comptr Aid Draft	1M
750:227	Analyt Physics IIa	3	640:244	Differential Equations	4
750:229	Analyt Physics IIa Lab	1	650:291*	Mechanics of Materials	3M
_____	Hum/Soc Elective (200+)	3	750:228	Analyt Physics IIb	3

Junior Year

650:342*	Design Mech Components	3M	650:471	Aircraft Flight Dynamics	3M
640:421*	Advanced Calculus	3M	650:350*	ME Measurements	4M
650:312*	Fluid Mechanics	3M	650:460	Aerodynamics	3M
650:210*	Intro to Aerospace Eng.	3M	650:401*	Mechanical Control Sys.	3M
650:351*	Thermodynamics	3M	650:388*	CAD in ME	3M

Senior Year

650:431	ME/AE Lab I	2M	650:433	Aerospace Lab II	2M
650:487	Aerospace Design Proj I	2M	650:488	Aerospace Design Proj II	2M
650:439	Multiphysics Simulations	3M	650:458	Aerospace Structures	3M
650:457	Spacecraft Mission Des	3M	650:463	Compr Fluid Dynamics	3M
650:449	Aerospace Materials; cf pg 6	3M	650:459	Aerospace Propulsion	3M
220:102	MicroEconomics	3	____-____	Hum/Soc Elective (200+)	3

- *The MAE courses marked with (*) above can be taken either fall or spring semester*
- *All MAE Departmental Electives can count for Technical Electives*

Departmental Electives

650:443	Vibrations	650:465	Orbital Mechanics
650:447	Probabilistic Models	650:474	Alt Energy I
650:451	Vehicle Dynamics	650:477	Alt Energy II
650:455	Des Mechanisms	650:478	ME Aspects Elec Packg
650:461	Int Comp Engines	650:481	Heat Transfer
650:462	Power Plants		

AEROSPACE ENGINEERING CURRICULUM FOR CLASS OF 2019

Freshman Year

160:159	Gen Chem for Engrs	3	160:160	Gen Chem for Engrs	3
160:171	Intro Experimentation	1	440:127	Intro Computers for Engrs	3
355:101	Expository Writing	3	440:221*	Eng'g Mech (Statics)	3
440:100	Intro to Engineering	1	640:152	Calculus for Eng'g	4
640:151	Calculus for Eng'g	4	750:124	Analytical Physics IB	2
750:123	Analytical Physics IA	2	_____	Hum/Soc Elective	3
_____	Hum/Soc Elective	3			

Sophomore Year

440:222*	Eng'g Mech (Dynamics)	3	220:102	Microeconomics	3
640:251	Multivariable Calculus	4	640:244	Differential Equations	4
650:210	Intro to Aerospace Eng	3M	650:291*	Mechanics of Materials	3M
750:227	Analyt Physics IIA	3	650:361*	Mechatronics	4M
750:229	Analyt Physics IIA Lab	1	650:388*	CAD in ME	3M
_____	Hum/Soc Elective (200+)	3			

Junior Year

640:421*	Advanced Calculus	3	650:401*	Syst Dynamics & Controls	3M
650:312	Fluid Mechanics	3M	650:458	Aerospace Structures	3M
650:342*	Design Mech Components	3M	650:460	Aerodynamics	3M
650:350*	ME Measurements	4M	650:471	Aircraft Flight Dynamics	3M
650:351*	Thermodynamics	3M	___ - ___	Technical Elective	3

Senior Year

650:431	Mech/Aero Eng Lab I	2M	650:433	Aero Eng Lab II	2M
650:439*	Multiphysics Simulations	3M	650:449	Aerospace Materials	3M
650:457	Spacecraft Mission Des	3M	650:459	Aerospace Propulsion	3M
650:487	Aerospace Design Proj I	2M	650:463	Compr Fluid Dynamics	2M
650:4XX	Departmental Elective	3M	650:488	Aerospace Design Proj II	3M
___ - ___	Technical Elective	3	___ - ___	Hum/Soc Elective (200+)	3

- *The MAE courses marked with (*) above can be taken either fall or spring semester*
- *All MAE Departmental Electives can count for Technical Electives*
- *Courses marked with (#) can count towards the Energy concentration*
- ***ASTRONAUTICS** specialization requires **ORBITAL MECHANICS** as Departmental or Technical Elective*

Departmental Electives

650:443	Vibrations	650:465	Orbital Mechanics
650:447	Probabilistic Models	650:474 [#]	Alt Energy I
650:451	Vehicle Dynamics	650:477 [#]	Alt Energy II
650:455	Des Mechanisms	650:478	ME Aspects Elec Packg
650:461 [#]	Int Comp Engines	650:481	Heat Transfer
650:462 [#]	Power Plants		

AEROSPACE ENGINEERING CURRICULUM FOR *CLASS OF 2020+*

Freshman Year

160:159	Gen Chem for Engrs	3	160:160	Gen Chem for Engrs	3
160:171	Intro Experimentation	1	440:127	Intro Computers for Engrs	3
355:101	Expository Writing	3	440:221*	Eng'g Mech (Statics)	3
440:100	Intro to Engineering	1	640:152	Calculus for Eng'g	4
640:151	Calculus for Eng'g	4	750:124	Analytical Physics IB	2
750:123	Analytical Physics IA	2	_____	Hum/Soc Elective	3
_____	Hum/Soc Elective	3			

Sophomore Year

440:222*	Eng'g Mech (Dynamics)	3	220:102	Microeconomics	3
640:251	Multivariable Calculus	4	640:244	Differential Equations	4
650:210	Intro to Aerospace Eng	3M	650:291*	Mechanics of Materials	3M
750:227	Analyt Physics IIA	3	650:361*	Mechatronics	4M
750:229	Analyt Physics IIA Lab	1	650:388*	CAD in MAE	3M
_____	Hum/Soc Elective (200+)	3			

Junior Year

640:421*	Advanced Calculus	3	650:401*	Syst Dynamics & Controls	3M
650:312	Fluid Mechanics	3M	650:449	Aerospace Materials	3M
650:342*	Design Mech Components	3M	650:458	Aerospace Structures	3M
650:350*	ME Measurements	4M	650:460	Aerodynamics	3M
650:351*	Thermodynamics	3M	650:471	Aircraft Flight Dynamics	3M

Senior Year

650:431	Mech/Aero Eng Lab I	2M	650:433	Aero Eng Lab II	2M
650:439*	Multiphysics Simulations	3M	650:459	Aerospace Propulsion	3M
650:457	Spacecraft Mission Des	3M	650:463	Compr Fluid Dynamics	3M
650:487	Aerospace Design Proj I	2M	650:488	Aerospace Design Proj II	2M
650:4XX	Departmental Elective	3M	___ - ___	Technical Elective	3
___ - ___	Technical Elective	3	___ - ___	Hum/Soc Elective (200+)	3

- *The MAE courses marked with (*) above can be taken either fall or spring semester*
- *All MAE Departmental Electives can count for Technical Electives*
- *Courses marked with (#) can count towards the Energy concentration*
- *ASTRONAUTICS specialization requires ORBITAL MECHANICS as Departmental or Technical Elective*

Departmental Electives

650:443	Vibrations	650:465	Orbital Mechanics
650:447	Probabilistic Models	650:474 [#]	Alt Energy I
650:451	Vehicle Dynamics	650:477 [#]	Alt Energy II
650:455	Des Mechanisms	650:478	ME Aspects Elec Packg
650:461 [#]	Int Comp Engines	650:481	Heat Transfer
650:462 [#]	Power Plants		

5. Technical Electives

Take two at least 3-credit courses from the science/math/engineering courses offered by the departments below that are not already required.

Code	Dept	Courses
105	Astrophysics	300+, 400+
115	Biochemistry	300+, 400+ (excluding 321)
117	Bioenvironmental Engineering	413, 414, 462, 468, 474, 492, 494, 495, 496
119	Biological Sciences	115, 116, 155, 408, 409
125	Biomedical Engineering	300+, 400+
146	Cell Biology and Neuroscience	200+, 300+, 400+
155	Chemical and Biochemical Engineering	300+, 400+
160	Chemistry	209, 251, 300+, 400+
180	Civil and Environmental Engineering	300+, 400+
198	Computer Science	200+, 300+, 400+
216	Ecology, Evolution, and Natural Resources	240, 401, 405, 431, 454, 486
332	Electrical and Computer Engineering	300+, 400+ (excluding 221/223, 373/375)
375	Environmental Sciences	202, 203, 302, 303, 307, 322, 340, 346, 360, 406, 407, 411, 421, 423, 424, 430, 434, 444, 453
400	Food Science	201, 202, 301, 302, 304, 411, 419
440	General Engineering (Packaging)	301, 302, 371, 373, 378, 403, 406, 408, 419, 420, 468, 471
447	Genetics	200+, 300+ (excluding 354), 400+
460	Geology	301, 304, 306, 402, 407, 414, 418
540	Industrial and Systems Engineering	200+, 300+, 400+ (excluding 461)
628	Marine Sciences	320, 472
635	Materials Science and Engineering	200+, 300+, 400+
640	Mathematics	250, 300+, 400+
650	Mechanical and Aerospace Engineering	298, 299, 300+, 400+ (except 467/468/487/488)
680	Microbiology	390, 480, 481, 494
694	Molecular Biology and Biochemistry	200+, 300+ (excluding 383), 411-414
750	Physics (Physics and Astronomy)	300+, 400+ (excluding 443, 444)
776	Plant Science	242, 305
960	Statistics	211, 212, 285, 379, 381, 382, 384, 400+

Note 1: All seminar courses, survey courses, special topics, independent studies, undergraduate and graduate research courses, internships and co-ops taken in departments other than MAE are EXCLUDED from technical electives credits in the MAE department.

6. Professional and Supplemental Programs

Dual Degree, Double major, and Minor programs

Minors, majors, and dual degrees provide students with the opportunity to broaden skill sets outside of engineering. These programs are offered in conjunction with various other undergraduate schools at Rutgers University, including the School of Arts and Sciences and the School of Environmental and Biological Sciences. For more information about these programs, see <http://soe.rutgers.edu/oas/minors-majors>

BS/Master's programs

There are three special joint programs offering the opportunity for engineering students to obtain a Master's degree within one calendar year of completing the baccalaureate degree requirements. Qualified School of Engineering students are eligible to apply for admission to these accelerated Master's Programs in their junior year. For more information, see <http://soe.rutgers.edu/oas/BS-Masters>

The James J. Slade Scholars Program

In the third year, students who have maintained a 3.2 university cumulative grade-point average may apply to the undergraduate director of their major department to be admitted into the James J. Slade Scholars Program. The Slade Scholar Program honors long-time School of Engineering faculty member James J. Slade who was a noted researcher, mathematician, and professor for 36 years. His commitment to teaching, scholarly excellence, and impact on students was legendary, and continues to resonate through this prestigious research program.

Each Slade Scholar prepares a plan of study under the guidance of a three-member faculty committee and the Honors Committee of the School of Engineering.

The chairperson of the student's committee shall be the research thesis adviser and should be a member of his or her major department. For more information, see <http://soe.rutgers.edu/slade>.

MAE Department Requirements:

1. GPA 3.2
2. Independent research and a thesis giving a total of six credits, **650:542/543 graduate level credits** which may be transferred in MS program, beyond the minimum required for graduation.
3. Thesis presented to advisor's group.
4. Participation at Poster Session on the first Monday after Rutgers Day.

Study Abroad

Many engineering students take advantage of Rutgers' Study Abroad educational opportunities choosing to study for a semester, a summer, or an academic year at one of the many international programs open to Rutgers students. Students can study abroad as early as sophomore year at locations including Hong Kong, Australia, London, South Africa, and more. Orientation sessions provide valuable information for making the necessary educational and logistical plans. For more information, see: <http://soe.rutgers.edu/study-abroad>.

Cooperative Experience (Co-Op)

Engineering students who have completed required major courses through the first semester of the junior year and have a cumulative GPA of at least 2.5 are eligible to participate in the Co-op program.

The MAE Co-op requires that students complete a 6-month, full-time (40 hrs/wk) work experience in a corporate engineering position, which may earn **6 credits towards technical electives** (see *Note 6*) upon student's request and if the student registers for the Co-op in Mechanical and Aerospace Engineering course (650:496/7). The MAE department requires continuous summer-fall or spring-summer experience.

After a student finds an engineering position in the company of his/her liking the following steps should be accomplished for technical elective credits in MAE:

- Submit job description for approval to the MAE undergraduate office.
- Complete Co-Op MAE form (this form is different from the Career Services one.)
<http://mae.rutgers.edu/undergraduate-forms>
- After approval of job description, register for 650:496/497.
- Upon completion of the internship the student should submit at the MAE undergraduate office the following:
 - A technical report of a minimum length of 20 pages, including tables, figures and references.
 - An evaluation letter from his/her supervisor indicating: 1) length and full time employment of the student, 2) his/her duties, and 3) assessment of his performance.

Note 2: Since this is a full time job the students are not encouraged to take courses during their co-op experience. If under extenuating circumstances a student is to take a course during his/her Co-Op, the student is reminded that all MAE classes have mandatory attendance and no credit will be given for missed classes.

The Office of Career Services provides listings of co-op opportunities, but students may also obtain positions on their own. For more information, see: <http://soe.rutgers.edu/coop>.

Note 3: No credit towards electives in MAE will be given if the student is not registered for 650:496/7.

Internship Experience

Engineering students who have completed required major courses through the sophomore year and have a cumulative GPA of at least 2.5 are eligible to participate in the Internship program.

The MAE Internship requires that students complete a 3-month, full-time (40 hrs/wk) work experience in a corporate engineering position, which may earn **3 credits towards a technical elective** (see *Note 6*) upon student's request and if the student registers for the Internship in Mechanical and Aerospace Engineering course (650:495). After a student finds an engineering position in the company of his/her liking the following steps should be accomplished to earn technical elective credits in MAE:

- Submit job description for approval to the MAE undergraduate office.
- Complete the MAE Internship form (this form is different from the Career Services one.)
<http://mech.rutgers.edu/sites/default/files/Internship%20%20Application.pdf>
- After approval of job description, register for 650:495.
- Upon completion of the internship the student should submit at the MAE undergraduate office the following:
 - A technical report of a minimum length of 15 pages (including tables, figures and references.)
 - An evaluation letter from his/her supervisor indicating: 1) length and full time employment of the student, 2) his/her duties, and 3) assessment of his performance.
 -

Note 4: Since this is a full time job the students are not encouraged to take courses during their internship experience. If under extenuating circumstances a student is to take a course during his/her internship, the student is reminded that all MAE classes have mandatory attendance and no credit will be given for missed classes.

The Office of Career Services provides listings of internship opportunities, but students may also obtain positions on their own. *MAE's internship/co-op is different than the SAS [Rutgers Internship/Co-op program \(RICP\)](#). The RICP program counts as a general elective only and technical elective credits will not be earned towards the ME or AE degrees through the RICP program.*

Note 5: No credit towards electives in MAE will be given if the student is not registered for 650:495.

Undergraduate Research

This experience seeks to expand student participation in research projects with mechanical and aerospace engineering faculty. It features high-quality interaction of students with faculty, access to appropriate facilities, and other professional development opportunities.

Students may earn up to **3 credits (total) counting towards a technical elective** upon student's request (see *Note 6*) in MAE if they register under 298, 398, 498 Undergraduate research during the Fall semester and/or 299, 399, 499 Undergraduate research during the Spring semester of their sophomore, junior and senior years, respectively.

The students are required to make a poster presentation of their research project and findings at the end of the academic year if they elect to use their undergraduate research experience for Technical Elective credits.

Note 6: Total number of Undergraduate Research/Internship/Co-Op experience credits that may count towards a Technical Elective is limited to **6 credits** (2 TEs).

Course descriptions for MAE courses as well as courses on Sciences, Humanities, and Math can be found at the pertinent Rutgers Course Catalogues. For example, MAE course descriptions are found at

http://catalogs.rutgers.edu/generated/nb-ug_0507/pg21489.html