Undergraduate Program Handbook

Department of Mechanical and Aerospace Engineering

http://mae.rutgers.edu

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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 underwent accreditation evaluation in the Fall semester of 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, and a standard Aerospace Engineering curriculum leading to a BS degree in Aerospace Engineering covering the areas of Aeronautical Engineering and Astronautical Engineering.

Students who select the Aerospace Engineering or Energy Systems concentration (for the ME degree) are required to take three of the departmental elective courses related to the aerospace or energy fields, respectively. These three courses can count towards the departmental or technical electives for the degree completion. Details of the standard ME curriculum and aerospace or energy concentrations are presented in the MAE Curriculum section of this handbook.

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

Students who select the Energy concentration (for the AE degree) are required to take three of the departmental elective courses related to the energy fields. These three courses can count towards the departmental or technical electives for the degree completion. 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:

1. an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics
2. an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors
3. an ability to communicate effectively with a range of audiences
4. an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts
5. an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives
6. an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions
7. an ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

2. MAE Curricula

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 Core courses, from which they can choose according to their interests and career goals. The MAE Department also offers two additional concentrations in Aerospace and Energy Systems.

1. *Standard Mechanical Engineering Curriculum*: Students pursuing an AE degree 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 Electives[1] 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 Electives[2] 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.*

2. *Standard Aerospace Engineering Curriculum*: Students following this concentration are required to take the courses described in the Aerospace Engineering section below *FOLLOWING THE CURRICULUM PERTINENT TO THEIR YEAR OF GRADUATION*.

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 Courses[2] as Technical electives (2 courses) and an extra Energy Systems Course. Students completing the requirements for this concentration receive an Energy Systems certificate in addition to their Aerospace 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.

650:467 Prerequisites: 650:312, 342 (w/291 & 388 prereqs), 350 & 351. 650-468 Prerequisite: 650:467.

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 announced on May 15th and you have the summer to finalize your groups.

There is a limit of 6 students per section depending on the project. Once the limit is reached no more students can be added. 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.

650:487 Prerequisites: 650: 312, 342 (w/291 & 388 prereqs), 350, & 351. 650:488 Prerequisite: 650:487.

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 6 students per section depending on the project. Once the limit is reached no more students can be added. 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 SHOULD HAVE ONLY AEROSPACE ENG (021) STUDENTS.*

Team building

Each team is composed of five (6) 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 6 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 on May 15th. 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

All the students register for 650:467 (ME 650 students) or 650:487 (AE 021 students) accoprding to their major when registration opens. After that they should form groupps and contact the faculty to secure a project. 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 selection begins in May of Junior year and should be completed by end of July 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. ME students must take three (3) Departmental Electives. If a student concentrates in Aerospace Engineering or Energy Systems he/she needs to take all three (3) courses from Aerospace Electives[1] or Energy Electives[2], respectively.

Fall Courses (Annual)

401 - System Dynamics and Controls*

443 - Vibrations

451 - Vehicle Dynamics ***(Bi-Annual Odd Years)***

455 - Design of Mechanisms

462 - Power Plants[2]

465 - Orbital Mechanics[1]

447 - Probabilistic Models in ME and AE Systems ***(Bi-Annual Even Years)***[1]

457 - Spacecraft Mission Design[1]

474 - Alternative Energy I[2]

Spring Core Courses (Annual)

401 - System Dynamics and Controls*

449 - Aerospace Materials[1]

458 - Aerospace Structures[1]

459 - Aerospace Propulsion[1]

460 - Aerodynamics[1]

461 - Internal Combustion Engines[2]

463 - Compressible Fluid Dynamics[1]

471 - Aircraft Flight Dynamics [1]

~~477 - Alternative Energy II[2]~~ This course is replaced by 16:650:605 Renewable Energy (It replaces 14:650:477 Alternative Energy II and it has the same content with the addition of mobile power.)

B. All *MAE Graduate Courses* may count as Departmental Electives upon approval of the undergraduate director.

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 upper level technical courses appropriate for mechanical engineers. The ME and AE curricula require two (2) technical electives to be chosen from the Technical Electives list on of this booklet. Any extra departmental elective courses talken in addition to the 3 required ones may be used as a technical electives.

   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 the section "Professional and Supplemental Programs" of this document).

   A student may take *MAE Graduate Courses* as technical electives with approval of the undergraduate director.

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 https://soe.rutgers.edu/oas/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 https://soe.rutgers.edu/oas/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

Mechanical Engineering
http://catalogs.rutgers.edu/generated/nb-ug_current/pg1304.html

Aerospace Engineering
http://catalogs.rutgers.edu/generated/nb-ug_current/pg1304.html

5. Mechanical Engineering Curricula per Graduation Class

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	650:298	Devel & Leadersh ME	1M
650:291*	Mech Materials	3M	650:388*	CAD in MAE	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 Prof	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 Components	3M
650:350*	MAE Measurements w/Lab	4M	650:439*	Multiphysics Simulations	3M
___-___	Hum/Soc Elective (200+)	3	650:351*	Thermodynamics	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 II	2M
650:481*	Heat Transfer	3M	650:432/3/5	Mech/Aero/Energy Lab II	2M
650:4XX	Dept/Aero/Energy Core	3M	650:4XX	Dept/Aero/Energy Core	3M
650:4XX	Dept/Aero/Energy Core	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 Departmental Electives

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 Departmental Electives

650:461	Internal Combustion Engines
650:462	Power Plants
650:474	Alternative Energy I
16:650:605	Renewable Energy

Departmental Electives (No Concentration)

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

+ any elective course from Aero/Energy classes

MECHANICAL ENGINEERING CURRICULUM FOR CLASS 2022

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	650:291*	Mechanics of Materials	3M
650:388*	CAD in MAE	3 M	650:361*	Mechatronics	4M
750:227	Analyt Physics IIA	3	750:228	Analyt Physics IIB	3
750:229	Analyt Physics IIA Lab	1	750:230	Analyt Physics IIB lab	1
650:289	Prof Devel & Leadersh ME	1M	___-___	Technical Elective	3

Concentrations: Aerospace Energy

Junior Year

640:421	Advanced Calculus	3	540:343*	Engineering Econ	3
650:342*	Design Mech Components	3M	635:407	Mech Prop Materials	3M
650:350*	MAE Measurements w/Lab	4M	650:312*	Fluid Mechanics	3M
650:351*	Thermodynamics	3M	650:439*+	Mutliphysics Simulations	3M
___-___	General Elective	3	___-___	Hum/Soc Elective (200+)	3

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 II	2M
650:481*	Heat Transfer	3M	650:432/3/5	Mech/Aero/Energy Lab II	2M
650:4XX	Dept/Aero/Energy Core	3M	650:4XX	Dept/Aero/Energy Core	3M
650:4XX	Dept/Aero/Energy Core	3M	___-___	Technical Elective	3
___-___	Hum/Soc Elective (200+)	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***
- ***(*+) 650:439 requires 650:312 as a co-rec/pre-rec among other prereqs.439 cannot be taken earlier than Spring Junior Year.***

Aerospace Departmental Electives

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 Departmental Electives

650:461	Internal Combustion Engines
650:462	Power Plants
650:474	Alternative Energy I
16:650:605	Renewable Energy

Departmental Electives (No Concentration)

650:451	Vehicle Dynamics
650:455	Design of Mechanisms
650:443	Vibrations

+ any elective course from Aero/Energy classes

MECHANICAL ENGINEERING CURRICULUM FOR CLASS 2023+

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	650:291*	Mechanics of Materials	3M
650:388*	CAD in MAE	3 M	650:351*	Thermodynamics	3M
750:227	Analyt Physics IIA	3	650:361*	Mechatronics	4M
750:229	Analyt Physics IIA Lab	1	750:228	Analyt Physics IIB	3
650:289	Prof Devel & Leadersh ME	1M	750:230	Analyt Physics IIB lab	1

Concentrations: Aerospace Energy

Junior Year

540:343*	Engineering Econ	3	635:407	Mech Prop Materials	3M
640:421	Advanced Calculus	3	650:312*	Fluid Mechanics	3M
650:342*	Design Mech Components	3M	650:439*+	Multiphysics Simulations	3M
650:350*	MAE Measurements w/Lab	4M	___-___	General Elective	3
___-___	Technical Elective	3	___-___	Technical Elective	3

Senior Year

650:431	Mech/Aero Eng Lab I	2M	650:401*	Sys Dynamics & Controls	3M
650:467	Design & Manufacturing I	2M	650:432/3/5	Mech/Aero/Energy Lab II	2M
650:481*	Heat Transfer	3M	650:468	Design & Manufacturing II	2M
650:4XX	Dept/Aero/Energy Core	3M	650:4XX	Dept/Aero/Energy Core	3M
650:4XX	Dept/Aero/Energy Core	3	___-___	General Elective	3
___-___	Hum/Soc Elective (200+)	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***
- ***(*+) 650:439 requires 650:312 as a co-rec/pre-rec among other prereqs.439 cannot be taken earlier than Spring Junior Year.***

Aerospace Departmental Electives	
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 Departmental Electives	
650:461	Internal Combustion Engines
650:462	Power Plants
650:474	Alternative Energy I
16:650:605	Renewable Energy

Departmental Electives (No Concentration)	
650:451	Vehicle Dynamics
650:455	Design of Mechanisms
650:443	Vibrations

+ any elective course from Aero/Energy classes

6. Aerospace Engineering Curricula per Graduation Class

AEROSPACE ENGINEERING CURRICULUM FOR CLASSES OF 2020 & 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	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*	MAE Measurements w/Lab	4M	650:460	Aerodynamics	3M
650:351*	Thermodynamics	3M	650:471	Aircraft Flight Dynamics	3M

Senior Year

650:431	MAE Lab I	2M	650:433	AE Lab	2M
650:439*+	Multiphysics Simulations	3M	650:459	Aerospace Propulsion	3M
650:457	Spacecraft Mission Des	3M	650:463	Compr Fluid Dynamics	3M
650:465	Orbital Mechanics	2M	650:488	Aerospace Design Proj II	2M
650:487	Aerospace Design Proj I	3M	___-___	Hum/Soc Elective (200+)	3
___-___	Technical Elective	3	___-___	Technical 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***
- ***Courses marked with (#) can count towards the Energy concentration***
- ***(*+) 650:439 requires 650:312 as a co-rec/pre-rec among other prereqs.439 cannot be taken earlier than Spring Junior Year.***

Departmental Electives

650:443	Vibrations	650:462#	Power Plants
650:447	Probabilistic Models	650:474#	Alt Energy I
650:451	Vehicle Dynamics	16:650:605	Renewable Energy
650:455	Design of Mechanisms	650:478	ME Aspects Elec Packg
650:461#	Int Comp Engines	650:481	Heat Transfer

AEROSPACE ENGINEERING CURRICULUM FOR CLASS OF 2022+

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	540:343*	Engineering Econ	3
640:251	Multivariable Calculus	4	640:244	Differential Equations	4
650:210	Intro to Aerospace Eng	3M	650:351*	Thermodynamics	3M
750:227	Analyt Physics IIA	3	650:361*	Mechatronics	4M
750:229	Analyt Physics IIA Lab	1	650:388*	CAD in MAE	3M
650:291*	Mechanics of Materials	3M			

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
___-___	Hum/Soc Elective (200+)	3	650:471	Aircraft Flight Dynamics	3M

Senior Year

650:431	MAE Lab I	2M	650:433	AE Lab	2M
650:439*+	Multiphysics Simulations	3M	650:459	Aerospace Propulsion	3M
650:457	Spacecraft Mission Des	3M	650:463	Compr Fluid Dynamics	3M
650:465	Orbital Mechanics	3M	650:488	Aerospace Design Proj II	2M
650:487	Aerospace Design Proj I	2M	___-___	Hum/Soc Elective (200+)	3
___-___	Technical Elective	3	___-___	Technical 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***
- ***Courses marked with (#) can count towards the Energy concentration***
- ***(*+) 650:439 requires 650:312 as a co-rec/pre-rec among other prereqs.439 cannot be taken earlier than Spring Junior Year.***

Departmental Electives

650:443	Vibrations	650:462#	Power Plants
650:447	Probabilistic Models	650:474#	Alt Energy I
650:451	Vehicle Dynamics	16:650:605	Renewable Energy
650:455	Des Mechanisms	650:478	ME Aspects Elec Packg
650:461#	Int Comp Engines	650:481	Heat Transfer

7. 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	200+, 300+, 400+
146	Cell Biology and Neuroscience	200+, 300+, 400+
155	Chemical and Biochemical Engineering	200+, 300+, 400+
160	Chemistry	209, 251, 300+, 400+
180	Civil and Environmental Engineering	200+, 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	200+, 300+, 400+ (excluding 221/223, 222/224, 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.

Newly Added TEs

10:762:420	Geographic Information Systems (GIS) for Health and Planning
10:762:451	Environmental Policy and Regulation
10:762:472	Transportation Planning
10:762:473	Transportation Policy
10:762:475	Designing for Sustainability
10:762:492	Design Studio: Plan and Design a Sustain
10:971:201	Introduction to Urban Planning and Design
10:971:315	Introduction to GIS
10:971:316	Introduction to Site Planning and Urban
11:550:301	Social and Cultural Aspects of Design
33:390:380	Investment Analysis (pre-req: 33:390:310
33:390:400	Corporate Finance (pre-req: 33:390:310)
33:390:420	Futures and Options (pre-req: 33:390:380
33:799:300	Global Procurement and Sourcing Strategies
33:799:301	Intro to Supply Chain Management
33:799:320	Fundamentals of Supply Chain Solutions
33:799:380	Project Management
33:799:460	Introduction to Six Sigma & Lean Manufacturing

8. 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 https://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 https://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 in the end of the Spring semester.

JJ SLADE Experience is a letter grade course.

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 sophomore 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.
- 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.
    - Technical report is due the ***first day of final exams*** in the semester you are register for the course.
    - 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.

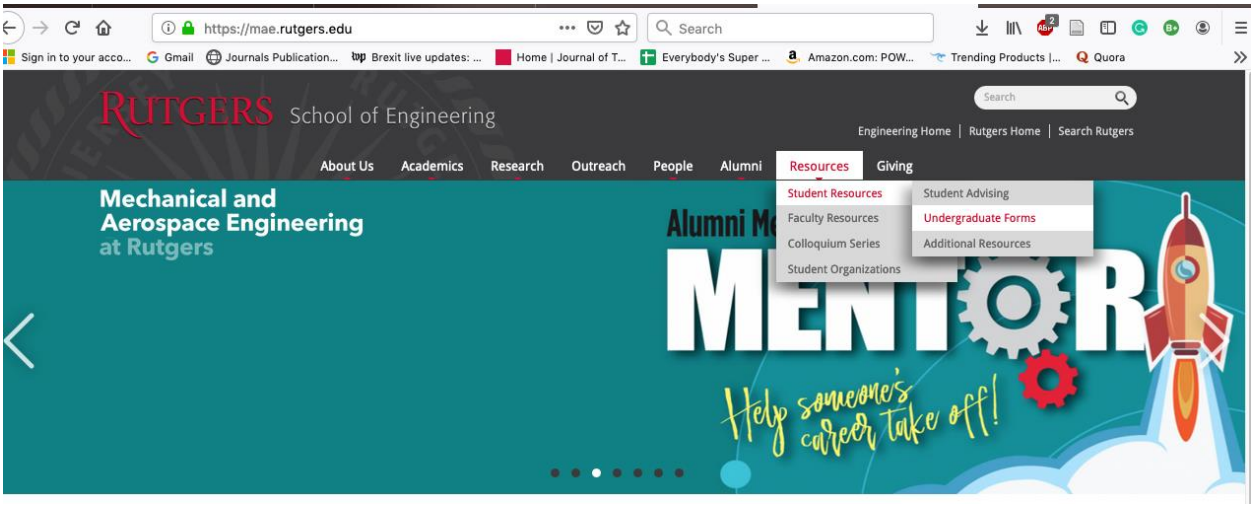
The Office of Career Services provides listings of co-op opportunities, but students may also obtain positions on their own. For more information, see: https://soe.rutgers.edu/oas/coop

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

Co-Op Experience is a Pass/Fail course.

Procedure to request Co-Op Credits:

Please go to **mae.rutgers.edu** Then go **Resources** tab -> **Undergraduate Forms** and complete the online **Co-Op** form.



An email from the department will be sent to you with the decision on your request. Please allow 72 hrs for a response.

If you do not receive a response within a reasonable amount of time, send an email to the Undergraduate Office Administrator Ms Cynthia Cartegna ccartegna@soe.rutgers.edu with your name on the subject line, your type of request (e.g., SPN) and the data of the online request.

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

Mechanical Engineering
http://catalogs.rutgers.edu/generated/nb-ug_current/pg1304.html

Aerospace Engineering
http://catalogs.rutgers.edu/generated/nb-ug_current/pg1304.html

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 electives 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.)
- 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.)
    - Technical report is due the ***first day of final exams*** in the semester you are register for the course.
    - 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.

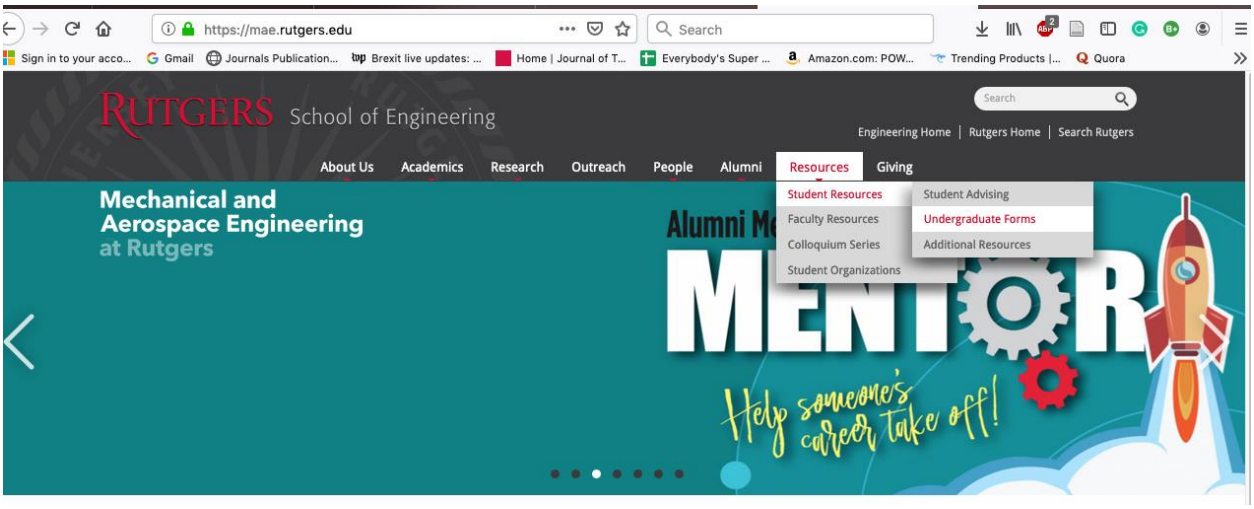
The Office of Career Services provides listings of internship opportunities, but students may also obtain positions on their own. *MAE's internship/co-op is different than the SAS Rutgers Internship/Co-op program (RICP). The RICP program counts as a general elective only. Technical elective credits will 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.

Internship Experience is a Pass/Fail course.

Procedure to request Internship Credits:

Please go to MAE website **mae.rutgers.edu** Then go **Resources** tab -> **Undergraduate Forms** and complete the online **Internship** form.



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Aerospace Engineering
http://catalogs.rutgers.edu/generated/nb-ug_current/pg1304.html

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.

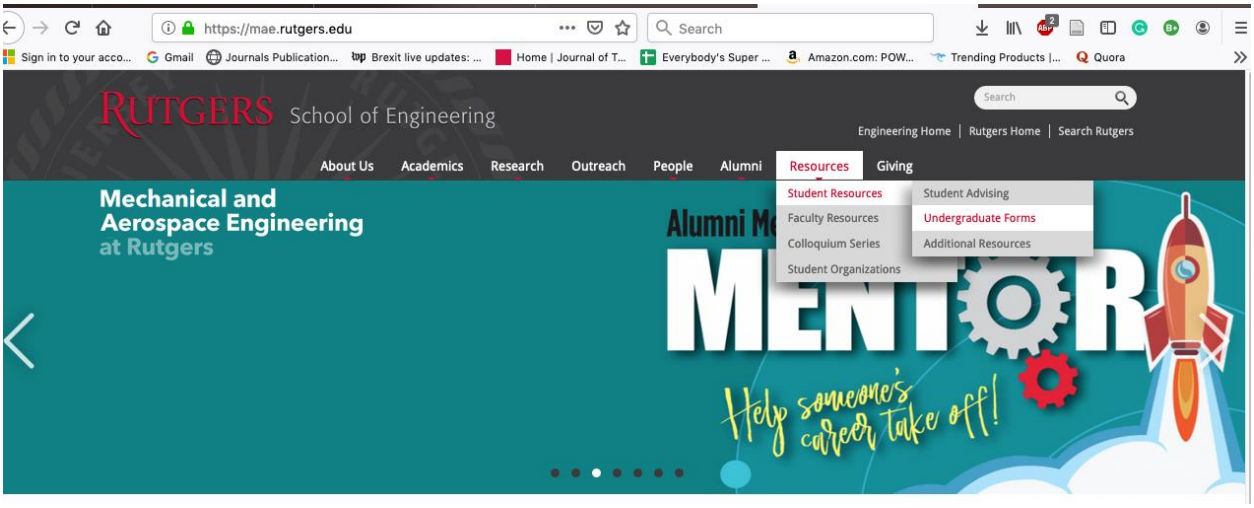
The students are required to make a poster presentation of their research project and findings at the end of the academic year if they elect to use their undergraduate research experience for Technical Elective credits.

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).

Undergraduate research is a letter grade course.

Procedure to request a Undergraduate Research Credits:

Please go to MAE website **mae.rutgers.edu** Then go **Resources** tab -> **Undergraduate Forms** and complete the online **Undergrad Research** form.



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http://catalogs.rutgers.edu/generated/nb-ug_current/pg1304.html

9. Departmental Student Advising

To further increase student awareness about the academic advising, the department has adopted Class Advisors for sophomore, junior and senior classes. Each graduating class has an MAE faculty advisor who is assigned at the beginning of the sophomore year and this faculty member remains the advisor until the student's graduation.

Also, we are instituting two Class Orientation sessions for each sophomore, junior and senior students in the first and second weeks of each AY, in which the students will be invited and strongly encouraged to participate.

This information is available on the website http://mae.rutgers.edu/student-advising under the tab "Student Advising".

The ***MAE Department Class Advisors*** for the next cohort of sophomore-senior students are:

Mechanical Engineering Program	Aerospace Engineering Program
2020 Bagchi	2020 Baruh
2021 Denda	2021 Zou
2022 Cook-Chennault	2022 Bilgen
2023 Drazer	2023 Knight

Students are encouraged to contact their class advisers for any courses and career related issues.

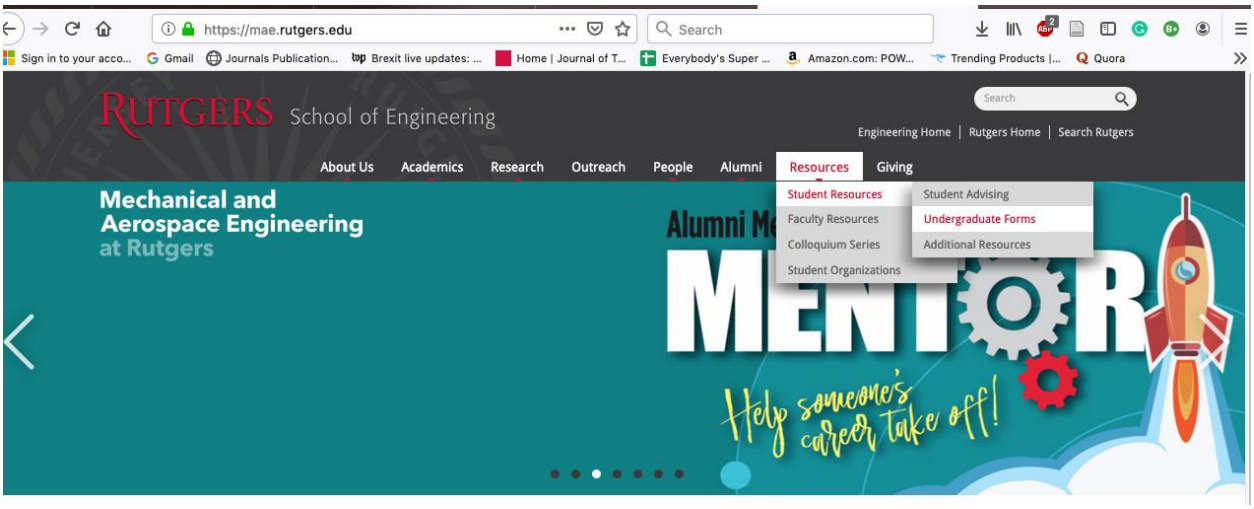
10. SPECIAL PERMISSION NUMBERS/PREREQUISITE OVERRIDES

Requests for special permission numbers (SPN) and prerequisite overrides are accepted ONLY electronically.

Procedure to request a Special Permission#:

Please go to MAE website **mae.rutgers.edu**

Then go **Resources** tab -> **Undergraduate Forms** and complete the online **SPN** or **Prereq** *form.*



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If you do not receive a response within a reasonable amount of time, send an email to the Undergraduate Office Administrator Ms Cynthia Cartegna ccartegna@soe.rutgers.edu with your name on the subject line, your type of request (e.g., SPN) and the data of the online request.

PLEASE NOTE: SPECIAL PERMISSION NUMBERS WILL ONLY BE ISSUED FOR CRITICAL SITUATIONS AND ONLY THROUGH E-MAIL REQUESTS.

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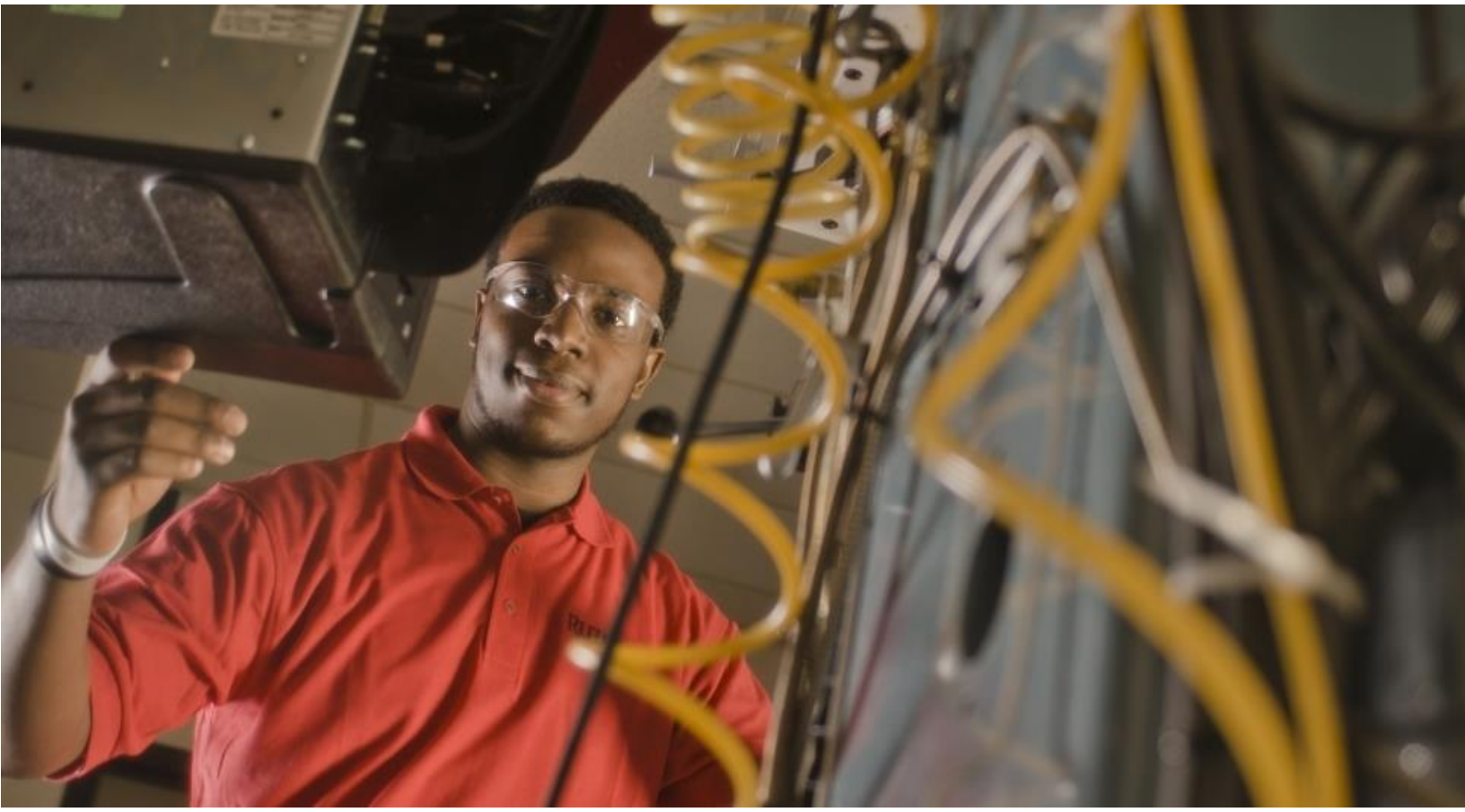

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