# Mechanical Engineering (BS)

The Mechanical Engineering degree program prepares its graduates for careers in mechanical and thermal systems design, analysis and manufacturing.

Mechanical engineering involves practical application of mechanical and thermal sciences to research, design, development, testing and manufacturing of a wide variety of products. Mechanical engineers contribute to the fields of transportation, power generation and energy conversion, environmental control and pollution abatement, noise control, and biomechanics. Recent developments have increased interest in such areas as robotics, mechatronics, precision engineering, automated manufacturing systems, combustion and propulsion. Student projects include Mini Baja, Formula Cars, and walking machines.

# **Plan Requirements**

First Year		
Fall Semester		
CH 101	Chemistry - A Molecular Science <sup>1</sup>	3
CH 102	General Chemistry Laboratory <sup>1</sup>	1
E 101	Introduction to Engineering & Problem Solving <sup>2</sup>	1
E 115	Introduction to Computing Environments	1
MA 141	Calculus I <sup>1</sup>	4
Acad Writing Researc	ch (p. 2) <sup>2</sup>	4
Select one of the follo	wing Economic courses:	3
ARE 201	Introduction to Agricultural & Resource Economics	
ARE 201A	Introduction to Agricultural & Resource Economics	
EC 201	Principles of Microeconomics	
EC 205	Fundamentals of Economics	
	Hours	17
Spring Semester		
CSC 113	Introduction to Computing - MATLAB	3
MA 241	Calculus II <sup>1</sup>	4
PY 205 & PY 206	Physics for Engineers and Scientists I and Physics for Engineers and Scientists I Laboratory <sup>1</sup>	4
GC 120	Foundations of Graphics	3
E 102	Engineering in the 21st Century	2
	Hours	16
Second Year		
Fall Semester		
MA 242	Calculus III	4
MAE 206	Engineering Statics <sup>2</sup>	3
PY 208 & PY 209	Physics for Engineers and Scientists II and Physics for Engineers and Scientists II Laboratory	4
MAE 200	Introduction to Mechanical Engineering Design	1

ST 370	Probability and Statistics for Engineers	3
	Hours	15
Spring Semester		
MA 341	Applied Differential Equations I	3
MAE 208	Engineering Dynamics <sup>2</sup>	3
MAE 201	Thermal-Fluid Sciences <sup>2</sup>	3
MAE 214	Solid Mechanics <sup>2</sup>	3
MAE 305	Mechanical Engineering Laboratory I	1
	Hours	13
Third Year		
Fall Semester		
ENG 331	Communication for Engineering and Technology	3
MAE 302	Engineering Thermodynamics II	3
MAE 306	Mechanical Engineering Laboratory II	1
MAE 308	Fluid Mechanics	3
MAE 315	Fundamentals of Vibrations	3
	Hours	13
Spring Semester		
ECE 331	Principles of Electrical Engineering	3
MAE 310	Heat Transfer Fundamentals	3
MAE 316	Strength of Mechanical Components	3
MSE 200	Mechanical Properties of Structural Materials	3
Tech Elective (p. 2)		3
	Hours	15
Fourth Year		
Fall Semester		
MAE 435	Principles of Automatic Control	3
MAE 405	Controls Lab	1
ISE 311	Engineering Economic Analysis	3
Select one of followi	ng ME Senior Design Part 1:	3
MAE 415	Mechanical Engineering Design I (This course should be followed by MAE 416)	
MAE 482	Engineering Entrepreneurship Senior Design I (This course should be followed by MAE 483)	
Tech Elective (p. 2)		3
	Hours	13
Spring Semester		
Select one of followi Design Part 1 choice	ng ME Senior Design Part 2 based on Senior	4
MAE 416	Mechanical Engineering Design II	
MAE 483 & MAE 484	Engineering Entrepreneurship Senior Design II	
	and Engineering Entrepreneurship Senior Design Lab	
Tech Elective (p. 2)		3
Ethics Elective (p. 2)		
	Hours	7
	Total Hours	109

<sup>1</sup> A grade of C or higher is required.

 $^2$  A grade of C- or higher is required.

Code	Title	Hours
GEP Courses		
GEP Humanities ( category-requirem	(http://catalog.ncsu.edu/undergraduate/gep- ients/gep-humanities/)	6
GEP Social Scien category-requirem	ces (http://catalog.ncsu.edu/undergraduate/gep- nents/gep-social-sciences/)	- 3
GEP Health and E undergraduate/ge studies/)	Exercise Studies (http://catalog.ncsu.edu/ p-category-requirements/gep-health-exercise-	2
GEP US Diversity undergraduate/ge	, Equity, and Inclusion (http://catalog.ncsu.edu/ p-category-requirements/gep-usdei/)	3
GEP Interdisciplin undergraduate/ge perspectives/)	ary Perspectives (http://catalog.ncsu.edu/ p-category-requirements/gep-interdisciplinary-	3
GEP Global Know category-requirem	<pre>/ledge (http://catalog.ncsu.edu/undergraduate/ge nents/gep-global-knowledge/) (verify requirement</pre>	ep- t)
World Language F gep-category-requ	Proficiency (http://catalog.ncsu.edu/undergradua uirements/world-language-proficiency/) (verify	te/

requirement)

### Total Hours

## **Ethics Elective**

Code	Title	Hours
EED 414/514	Ethics for Engineering Education	3
IDS 201	Environmental Ethics	3
MS 402	Advanced Military Science - Military Justice, Ethi and Professionalism	ics 3
NS 420	Naval Leadership and Ethics	3
PHI 214	Issues in Business Ethics	3
PHI 227	Data Ethics	3
PHI/STS 325	Bio-Medical Ethics	3
PHI 375	Ethics	3
STS 302	Contemporary Science, Technology and Human Values	3
STS 304	Ethical Dimensions of Progress	3

17

# Acad Writing Research

Code	Title	Hours
Acad Writing Re	search	
ENG 101	Academic Writing and Research	4
FLE 101	Academic Writing and Research	4
ENG 1GEP		
Transfer students transfer credit tak	with fewer than 4 credits of college composition e the following.	
ENG 202	Disciplinary Perspectives in Writing	3
Tech Electives		
Code	Title	Hours

ooue	Thic	nours
Choose From:		
ME technical ele	ctives	
MAE 342	Introduction to Automotive Engineering	3

MAE 398	Relativistic Dynamics: An Evolution in Space, Time, and Matter	3
MAE 403	Air Conditioning	3
MAE 406	Energy Conservation in Industry	3
MAE 407	Steam and Gas Turbines	3
MAE 408	Internal Combustion Engine Fundamentals	3
MAE 410	Modern Manufacturing Processes	3
MAE 412	Design of Thermal System	3
MAE 413	Design of Mechanical Systems	3
MAE 420	Dynamic Analysis of Human Movement	3
MAE 421	Design of Solar Energy Systems	3
MAE 426	Fundamentals of Product Design	3
MAE 430	Applied Finite Element Analysis	3
MAE 440	Non-Destructive Testing and Evaluation	3
MAE 448	Computational Methods in Engineering	3
MAE 495	Special Topics in Mechanical and Aerospace	3
	Engineering	
MAE 496	Undergraduate Project Work in Mechanical and Aerospace Engineering	3
AE technical ele	ctives	
MAE 452	Aerodynamics of V/STOL Vehicles	3
MAE 455	Boundary Layer Theory	3
MAE 456	Computational Methods in Aerodynamics	3
MAE 457	Flight Vehicle Stability and Control	3
MAE 459	Rocket Propulsion	3
MAE 458	Propulsion	3
MAE 467	Introduction to Space Flight	3
MAE 470	Space Exploration Systems	3
MAE 472	Aerospace Structures II	3
MAE 500-level c	ourses (with departmental approval)	
Available to stude	ents who are admitted to an engineering ABM	
program OR have required 3rd year	e a minimum 3.5 overall GPA and completed all MAE lecture courses	
MAE 501	Advanced Engineering Thermodynamics	3
MAE 502	Aerosol Science and Technology	3
MAE 504	Fluid Dynamics Of Combustion I	3
MAE 505	Heat Transfer Theory and Applications	3
MAE 508	Automotive Power Systems	3
MAE 511	Advanced Dynamics I	3
MAE 513	Principles of Structural Vibration	3
MAE 515	Advanced Automotive Vehicle Dynamics	3
MAE 517	Advanced Precision Manufacturing for Products.	3
	Systems and Processes	
MAE 518	Acoustic Radiation I	3
MAE 520	Dynamic Analysis of Human Movement	3
MAE 521	Linear Control and Design For Mimo Systems	3
MAE 522	Non Linear System Analysis and Control	3
MAE 525	Advanced Flight Vehicle Stability and Control	3
MAE 526	Fundamentals of Product Design	3
MAE 528	Experimental Flight Testing	3
MAE 530	Optical Engineering	3
MAE 531	Engineering Design Optimization	3
MAE 532	Smart Structures and Micro-Transducers	3

MAE 533	Finite Element Analysis I	3
MAE 534	Mechatronics Design	3
MAE 535	Design of Electromechanical Systems	3
MAE 536	Micro/Nano Electromechanical Systems	3
MAE 537	Mechanics Of Composite Structures	3
MAE 538	Smart Structures and Materials	3
MAE 539	Advanced Materials	3
MAE 540	Advanced Air Conditioning Design	3
MAE 541	Advanced Solid Mechanics I	3
MAE 543	Fracture Mechanics	3
MAE 544	Robot Mechanics and Control	3
MAE 545	Metrology For Precision Manufacturing	3
MAE 546	Photonic Sensor Applications in Structure	3
MAE 548	Computational Methods in Engineering	3
MAE 550	Foundations Of Fluid Dynamics	3
MAE 551	Airfoil Theory	3
MAE 552	Introduction to Experimental Fluid Dynamics and Measurement Systems	3
MAE 553	Compressible Fluid Flow	3
MAE 554	Hypersonic Aerodynamics	3
MAE 555	Applications of Acoustic and Elastic Wave Propagation	3
MAE 558	Microfluidics and Nanofluidics	3
MAE 560	Computational Fluid Mechanics and Heat Transfer	3
MAE 561	Wing Theory	3
MAE 562	Physical Gas Dynamics	3
MAE 570	Space Exploration Systems	3
MAE 573	Hydrodynamic Stability and Transition	3
MAE 575	Advanced Propulsion Systems	3
MAE 577	Multiscale Two-phase Flow Simulations	3
MAE 589	Special Topics In Mechanical and Aerospace Engineering	3
Other engineerir approval)	ng technical electives (with departmental	

Contact your MAE academic advisor for options

# **Semester Sequence**

This is a sample.

First Year

Fall Semester		Hours
CH 101	Chemistry - A Molecular Science <sup>1</sup>	3
CH 102	General Chemistry Laboratory <sup>1</sup>	1
E 101	Introduction to Engineering & Problem Solving <sup>2</sup>	1
E 115	Introduction to Computing Environments	1
ENG 101	Academic Writing and Research <sup>2</sup>	4
MA 141	Calculus I <sup>1</sup>	4
Select one of the following Economics courses:		3
EC 205	Fundamentals of Economics	
EC 201	Principles of Microeconomics	
ARE 201	Introduction to Agricultural & Resource Economics	

GEP Health and Exercise Studies (http://catalog.ncsu.edu/ undergraduate/gep-category-requirements/gep-health-exercisestudies/)

	Hours	18
Spring Semester		
CSC 113	Introduction to Computing - MATLAB	3
MA 241	Calculus II <sup>1</sup>	4
PY 205	Physics for Engineers and Scientists I <sup>1</sup>	3
PY 206	Physics for Engineers and Scientists I Laboratory <sup>1</sup>	1
E 102	Engineering in the 21st Century	2
GC 120	Foundations of Graphics	3
GEP Health and Exer undergraduate/gep-ca studies/)	cise Studies (http://catalog.ncsu.edu/ ategory-requirements/gep-health-exercise-	1
	Hours	17
Second Year		
Fall Semester		
MA 242	Calculus III	4
MAE 200	Introduction to Mechanical Engineering Design	1
PY 208	Physics for Engineers and Scientists II	3
PY 209	Physics for Engineers and Scientists II Laboratory	1
MAE 206	Engineering Statics <sup>2</sup>	3
ST 370 or ST 371	Probability and Statistics for Engineers or Introduction to Probability and Distribution Theory	3
GEP Requirement (ht category-requirement	tp://catalog.ncsu.edu/undergraduate/gep- s/)	3
	Hours	18
Spring Semester		
MA 341	Applied Differential Equations I	3
MAE 208	Engineering Dynamics <sup>2</sup>	3
MAE 201	Thermal-Fluid Sciences <sup>2</sup>	3
MAE 214	Solid Mechanics <sup>2</sup>	3
MAE 305	Mechanical Engineering Laboratory I	1
GEP Requirement (ht	tp://catalog.ncsu.edu/undergraduate/gep-	3
category-requirement	s/)	
	Hours	16
Third Year		
Fall Semester		
ENG 331	Communication for Engineering and	3
MAE 308	rechnology	
	Fluid Mechanics	3
MAL 313	Fluid Mechanics Fundamentals of Vibrations	3 3
MAE 306	Fluid Mechanics Fundamentals of Vibrations Mechanical Engineering Laboratory II	3 3 1
MAE 306 MAE 302	Fluid Mechanics Fundamentals of Vibrations Mechanical Engineering Laboratory II Engineering Thermodynamics II	3 3 1 3
MAE 306 MAE 302 GEP Requirement (ht	Fluid Mechanics Fundamentals of Vibrations Mechanical Engineering Laboratory II Engineering Thermodynamics II tp://catalog.ncsu.edu/undergraduate/gep-	3 3 1 3 3
MAE 306 MAE 302 GEP Requirement (ht category-requirement	Fluid Mechanics Fundamentals of Vibrations Mechanical Engineering Laboratory II Engineering Thermodynamics II tp://catalog.ncsu.edu/undergraduate/gep- s/) Hours	3 3 1 3 3
MAE 313 MAE 306 MAE 302 GEP Requirement (ht category-requirement	Fluid Mechanics Fundamentals of Vibrations Mechanical Engineering Laboratory II Engineering Thermodynamics II tp://catalog.ncsu.edu/undergraduate/gep- s/) Hours	3 3 1 3 3 3
MAE 313 MAE 306 MAE 302 GEP Requirement (ht category-requirement Spring Semester MAE 310	Fluid Mechanics Fundamentals of Vibrations Mechanical Engineering Laboratory II Engineering Thermodynamics II tp://catalog.ncsu.edu/undergraduate/gep- s/) Hours Heat Transfer Fundamentals	3 3 1 3 3 <b>16</b> 3
MAE 313 MAE 306 MAE 302 GEP Requirement (ht category-requirement Spring Semester MAE 310 ECE 331	Fluid Mechanics Fundamentals of Vibrations Mechanical Engineering Laboratory II Engineering Thermodynamics II tp://catalog.ncsu.edu/undergraduate/gep- s/) Hours Heat Transfer Fundamentals Principles of Electrical Engineering	3 3 1 3 3 <b>16</b> 3 3

1

MSE 200	Mechanical Properties of Structural Materials	3
MAE 316	Strength of Mechanical Components	3
Technical Elective (p	. 2)	3
	Hours	15
Fourth Year		
Fall Semester		
MAE 435	Principles of Automatic Control	3
MAE 405	Controls Lab	1
ISE 311	Engineering Economic Analysis	3
Select one of following	ng ME Senior Design Part 1:	3
MAE 415	Mechanical Engineering Design I (This course should be followed by MAE 416)	
MAE 482	Engineering Entrepreneurship Senior Design I (This course should be followed by MAE 483)	
Technical Elective (p	. 2)	3
	Hours	13
Spring Semester		
Select one of followin Design Part 1 choice	ng ME Senior Design Part 2 based on Senior	4
MAE 416	Mechanical Engineering Design II	
MAE 483 & MAE 484	Engineering Entrepreneurship Senior Design II and Engineering Entrepreneurship Senior	
	Design Lab	
Technical Elective (p	. 2)	3
Ethics ( (p. 2)GEP Requirement (http://catalog.ncsu.edu/ undergraduate/gep-category-requirements/))		3
GEP Requirement (h	ttp://catalog.ncsu.edu/undergraduate/gep-	3
category-requiremen	ts/)	
	Hours	13
	Total Hours	126

<sup>1</sup> Courses required for Change of Degree Audit (CODA). A grade of C or higher is required.

<sup>2</sup> A grade of C- or higher is required, E 115 requires satisfactory completion (S).

## **Career Opportunities**

#### **Career Titles**

- Aeronautical & Aerospace Engineer
- Agricultural Engineer
- Airport Engineer
- Automotive Engineer
- Civil Engineering Technician
- · Cost Estimator
- Energy Engineer
- Engineering Professor
- Environmental Engineer
- Fuel Cell Engineers
- Industrial Designer
- Industrial Engineer

- Industrial Engineering Technician
- Materials Engineer
- Mechanical Engineer
- Mechanical Engineering Technician
- · Mechanical Engineering Technologists and Technicians
- Mechatronics Engineers
- Nuclear Engineer
- Nuclear Fuels Research Engineer
- Operating Engineer
- Petroleum Engineer
- Photogrammetrist
- Photonics Engineers
- Product Safety Engineer
- · Quality Control Managers
- Robotics Engineers
- Sanitary Engineer
- · Solar Energy Systems Designer
- Solar Energy Systems Engineers
- Structural Engineer
- Sustainability Specialists
- Tool and Machine Designer
- Transportation Engineer
- Wind Energy Engineer
- Wind Turbine Service Technicians

## Learn More About Careers

NCcareers.org (https://nccareers.org/)

Explore North Carolina's central online resource for students, parents, educators, job seekers and career counselors looking for high quality job and career information.

Occupational Outlook Handbook (https://www.bls.gov/ooh/) Browse the Occupational Outlook Handbook published by the Bureau of Labor Statistics to view state and area employment and wage statistics. You can also identify and compare similar occupations based on your interests.

Career One Stop Videos (https://www.careeronestop.org/) View videos that provide career details and information on wages, employment trends, skills needed, and more for any occupation. Sponsored by the U.S. Department of Labor.

Focus 2 Career Assessment (https://careers.dasa.ncsu.edu/explorecareers/career-assessments/) (NC State student email address required) This career, major and education planning system is available to current NC State students to learn about how your values, interests, competencies, and personality fit into the NC State majors and your future career. An NC State email address is required to create an account. Make an appointment with your career counselor (https:// careers.dasa.ncsu.edu/about/hours-appointments/) to discuss the results.

Focus 2 Apply Assessment (https://www.focus2career.com/Portal/ Register.cfm?SID=1929) (Available to prospective students) A career assessment tool designed to support prospective students in exploring and choosing the right major and career path based on your unique personality, interests, skills and values. Get started with Focus 2 Apply and see how it can guide your journey at NC State.

American Society of Mechanical Engineers (https://www.asme.org/)

American Society of Heating, Refrigeration & Air Conditioning Engineers (https://www.ashrae.org/) Society of Automotive Engineers (https://www.sae.org/)

National Society of Professional Engineers (https://www.nspe.org/)