Mechanical Engineering (ME, AE)

B.S. in (https://catalog.und.edu/undergraduateacademicinformation/departmentalcoursesprograms/mechanicalengineering/ae-bs/)Aerospace Engineering

B.S. in Mechanical Engineering (https://catalog.und.edu/undergraduateacademicinformation/departmentalcoursesprograms/mechanicalengineering/me-bs/)

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Freshman Year		
First Semester		**Credits**
CHEM 121	General Chemistry I [1]	3
CHEM 121L	General Chemistry I Laboratory [1]	1
ENGL 110	College Composition I [1]	3
MATH 165	Calculus I [1]	4
ME 101	Introduction to Mechanical Engineering [1,2]	3
Arts and Humanities		3
	Credits	**17**
Second Semester		
ENGR 200	Computer Applications in Engineering [1,2]	2
ENGL 130	Composition II: Writing for Public Audiences [1]	3
MATH 166	Calculus II [1]	4
PHYS 251	University Physics I [1]	4
Arts and Humanities		3
	Credits	**16**
Sophomore Year		
First Semester		
ENGR 201	Statics [1]	3
MATH 265	Calculus III [1]	4
ME 201	Student Design [1,2]	2
ME 341	Thermodynamics [1]	3
PHYS 252	University Physics II [1]	4
	Credits	**16**
Second Semester		
ENGR 202	Dynamics [1]	3
ENGR 206	Fundamentals of Electrical Engineering	3
ENGR 203	Mechanics of Materials [1]	3
MATH 266	Elementary Differential Equations	3
Social Science		3
	Credits	**15**
Junior Year		
First Semester		
ENGR 460	Engineering Economy	3
ME 301	Materials Science	3
ME 306	Fluid Mechanics	3
Technical Elective [3]		3
ME 324 CONTROL	New Course in Approval Process	3
	Credits	**15**
Second Semester		
ME 323	Machine Component Design	3
ME 323L	Machine Component Design Laboratory	1
ME 418	Manufacturing Processes [4]	3
ME 418L	Manufacturing Processes Laboratory [4]	1
ME 474	Fundamentals of Heat and Mass Transfer	3
MATH 321	Applied Statistical Methods [5]	3
Technical Elective [3]		3
	Credits	**17**
Senior Year		
First Semester		
ME 480	Mechanical Engineering Seminar [4]	3
ME 483	Mechanical Measurements Laboratory [4]	3
ME 487	Engineering Design [4]	2
Arts and Humanities		3
Technical Electives [3]		6
	Credits	**17**
Second Semester		
ME 488	Engineering Design [4]	3
ENGR 340	Professional Integrity in Engineering [2]	3
Technical Electives [3]		9
	Credits	**15**
	Total Credits	**128**

[1] Students must achieve a grade of “C” or better.

[2] ME 101 Introduction to Mechanical Engineering, ME 201 Student Design, ENGR 200 Computer Applications in Engineering and ME 397 Cooperative Education may be waived by successful completion of ME 102 Professional Assessment and Evaluation. The ethics requirement as represented by ENGR 340 Professional Integrity in Engineering may also be waived, but not the University’s Essential Studies Requirements.

[3] Three technical electives must be completed from UND, one in each stem unless pursuing the aerospace concentration. One technical elective can be taken outside the ME Department within other CEM Departments, Math or Physics. The course must be at the 300-level or higher and be consistent with the student’s individual learning plan.

[4] Course must be completed from UND.

[5] ChE 315 of an alternative calculus-based statistics course may be substituted for MATH 321 with approval of the ME Department.

* All transfer courses must be completed with a grade of "C" or better.

Students must complete enough electives to bring total credit hours up to the 128. Special Emphasis courses can fulfill an essential studies requirement (example-Chemistry 121, General Chemistry I, will count toward the Quantitative Reasoning special emphasis as well as the Math/Science/Tech breadth of knowledge area). Please Note: Every student must fulfill all University, Departmental, and Essential Studies requirements. (https://und.edu/academics/essential-studies/)

Mechanical Engineering

ME 101. Introduction to Mechanical Engineering. 3 Credits.
This course introduces students to the Mechanical Aerospace Engineering disciplines and the engineering design process. The class focuses on developing computer-based 3D parametric modeling abilities and engineering design skills to produce an engineering design project prototype. Students are introduced to conventional practices and standards commonly employed in engineering design including CAD modeling of Parts, Assemblies, and creating detailed Drawings. Basic design, modeling, analysis, and testing of a machine or system will be employed along with problem solving as applied to a final design project. Prerequisite: College of Engineering Mines majors, or consent of Instructor. F,S.

ME 102. Professional Assessment and Evaluation. 1 Credit.
This course is designed for students with industrial experience. Students complete a portfolio documenting educational and work experiences for evaluation, and individualized curriculum plans are developed. Various academic programs in engineering are also introduced. Based on the assessment and evaluation, some engineering requirements may be waived. S/U grading only. Prerequisite: Work experience and/or technician school training plus completion of CHEM 121, CHEM 121L, PHYS 251, PHYS 252, MATH 165, MATH 166, and MATH 265. S/U grading. F,S,SS.

ME 201. Student Design. 2 Credits.
Team problem solving with design and build of a machine or mechanism, typically ASME Design Contest project. Machine shop safety and introduction to fabrication processes. Special topic lectures on contemporary Mechanical Engineering issues and research activities. Prerequisite: ME 101 or ENGR 101. Corequisite: PHYS 251 or ENGR 201. F.

ME 201C. Student Design Lecture. 1 Credit.
Team problem solving with design and build of a machine or mechanism, typically ASME Design Contest project. Machine shop safety and introduction to fabrication processes. Special topic lectures on contemporary Mechanical Engineering issues and research activities. Prerequisite: ME 101 with a grade of C or better. Corequisite: PHYS 251 or ENGR 201. F,S.

ME 201L. Student Design Lab. 1 Credit.
Fabrication, testing, and evaluation of a student designed prototype from the ME 201C - Student Design Lecture course. Prerequisite: ME 201C with a grade of C or better. SS.

ME 290. Laboratory Problems. 1-3 Credits.
Laboratory investigations of interest to student and faculty. Repeatable to a maximum of 6 credits. Prerequisite: Consent of instructor. Repeatable to 6.00 credits. On demand.

ME 301. Materials Science. 3 Credits.
The theory of the structure of matter, the prediction and evaluation of engineering properties of materials. Prerequisite: CHEM 121 with a grade of C or better and PHYS 252 with a grade of C or better. F.

ME 306. Fluid Mechanics. 3 Credits.
Fluid properties; fluid statics and dynamics; transport theory and transport analogies, conservation of mass, energy, and momentum; dimensional analysis; boundary layer concepts; pipe flows; compressible flow; open channel flow. Prerequisite: PHYS 251 and MATH 265, both with a grade of C or better. F,S.

ME 313. Material Properties and Selection. 3 Credits.
Study of relationships between materials, manufacture and design of engineering component. Prerequisite: ME 301. On demand.

ME 322. Design of Machinery. 3 Credits.
Analytical study of motions, velocities, accelerations and forces for design of machine elements. Introduction to spatial mechanisms, robotics, and actuator selection. Prerequisite: ENGR 200 with a grade of C or better, ENGR 202 with a grade of C or better and ME 201 with a grade of C or better. F,S.

ME 323. Machine Component Design. 3 Credits.
Design of machine elements such as shafts, bearings, gears, clutches, springs, threaded components, and bolted, riveted, welded, and bonded joints. Stress and failure theory analyses of the implementation of machine components are covered. Prerequisite: ENGR 203 with a grade of C or better and ME 101 with a grade of C or better. Corequisite: ME 323L. S.

ME 323L. Machine Component Design Laboratory. 1 Credit.
Application of design and analysis tools developed in the Machine Component Design course. Laboratory emphasizes creative design, analysis techniques, construction methods, and design report writing. Prerequisite: ENGR 203 with a grade of C or better and ME 101 with a grade of C or better. Corequisite: ME 323. S.

ME 324. Control Systems. 3 Credits.
Theory, analysis, and design of linear closed-loop control systems containing electronic, hydraulic, and mechanical components. Differential equations. LaPlace transforms, Nyquist and Bode diagrams are covered. Prerequisite: ENGR 202 and MATH 266. F,S.

ME 341. Thermodynamics. 3 Credits.
Fundamental energy relationships applied to both closed and open systems. Determination of thermodynamic properties, first and second laws of thermodynamic processes and basic cycles. Prerequisite: PHYS 251 and MATH 166, both with a grade of C or better. F,S.

ME 342. Intermediate Thermodynamics. 3 Credits.
Power and refrigeration cycles. Exergy analysis, psychrometrics, reacting and non-reacting mixtures. Prerequisite: ME 341 with a grade of C or better. On demand.

ME 370. Engineering Disasters and Ethics. 3 Credits.
Engineering disasters will be the basis for teaching an ethics course to engineering students. Starting with the premise that most people know the difference between right and wrong (this is not a course on criminal activity!), the course explores how engineers, in spite of their best intentions, sometimes create disastrous situations. The effect of cumulative adverse detail is difficult to teach except with case studies. Also explored is cost vs. safety trade-offs, the role of lawsuits, and government regulation. Prerequisite: Junior or Senior standing. F.

ME 388. Undergraduate Research in Mechanical Engineering. 3 Credits.
Students will conduct a supervised independent study in a research lab or as part of a design team culminating in a research report. Prerequisite: Approval from department chair and faculty sponsor. S.

ME 397. Cooperative Education. 1-2 Credits.
A practical work experience with an employer closely associated with the student's academic area. Arranged by mutual agreement among student, department and employer. Formal application and/or interview to site is required. A part-time cooperative education (20 hours+/wk) over the semester is required for 1 credit of ME 397. A full-time cooperative education (40 hours/wk) over the semester is required for 2 credits of ME 397. Prerequisite: ENGR 202 with a grade of C or better and ENGR 203 with a grade of C or better. Repeatable to 12.00 credits. S/U grading. F,S,SS.

ME 398. Engineering Study Abroad Experience. 1 Credit.
Engineering Travel Abroad combines travel abroad for engineering students along with a significant learning component in engineering. The course will accommodate student travel opportunities led by engineering faculty. The course includes a significant learning component prior to travel requiring students to seek background information related to the engineering topics included in the travel experience. The course will require a completed essay prior to travel as well as an executive summary of the travel experience upon the return. This one credit class can be combined with a 2 credit cooperative experience from ME 397 to allow students to waive one technical elective in mechanical engineering. Prerequisite: Students should be matriculated in mechanical engineering or have a significant interest in engineering. Repeatable to 3.00 credits. S/U grading. S.

ME 417. Friction, Wear and Lubrication. 3 Credits.
Tribology is the study of friction, wear and lubrication. This is an interdisciplinary discipline which requires knowledge on surface science, fundamental laws of physics, chemistry, materials science and manufacturing. Course topics include friction on different materials, wear mechanisms, lubrication regimes, surface metrology, gear and bearing failures, green tribology and tribological opportunities in additive manufacturing. Prerequisite: ME 301. On demand.

ME 418. Manufacturing Processes. 3 Credits.
Descriptive and analytical study of manufacturing methods and economics as they pertain to machining, metrology and automation. Prerequisite: ENGR 203 with a grade of C or better and ME 301. S.

ME 418C. Manufacturing Processes. 3 Credits.
Descriptive and analytical study of manufacturing methods and economics as they pertain to machining, metrology and automation. Prerequisite: ENGR 203 with a grade of C or better and ME 301. F.

ME 418CL. Manufacturing Processes Laboratory. 1 Credit.
Laboratory to complement M E 418C. Prerequisite: Admission to the professional Mechanical Engineering program. F.

ME 418L. Manufacturing Processes Laboratory. 1 Credit.
Application of manufacturing methods in the Manufacturing Processes course including casting, machining, welding/soldering/brazing, forming (metals and plastics), heat treatment, metrology and automation. Prerequisite or Corequisite: ME 418. S,SS.

ME 420. Composite Materials. 3 Credits.
The course covers the mechanics of composite laminates and plates, composite manufacturing processes, and composite testing techniques. Prerequisite: ME 301. On demand.

ME 424. Systems Dynamics and Control. 3 Credits.
Theory, analysis, and design of linear closed-loop control systems containing electronic, hydraulic, and mechanical components. Differential equations. LaPlace transforms, Nyquist and Bode diagrams are covered. Prerequisite: MATH 266 and ME 322. On demand.

ME 425. Numerical Methods for Engineers Using Advanced MATLAB Programming Techniques. 3 Credits.
In this course, numerical methods for solving differential equations, advanced Matlab programming techniques and their applications to practical engineering problems will be presented. Topics covered include Matlab programming, solving systems of equations, linear algebra, function and data manipulation, and differential equations. For students who enroll for graduate credit, they will apply class concepts to solve an engineering problem related to their research problems as a course project. Prerequisite: ENGR 200 and MATH 266. S.

ME 426. Mechanical Vibrations. 3 Credits.
Vibration analysis and design as it applies to single and multi degree freedom mechanical systems, isolation and absorption of vibration, vibration of continuous systems, numerical methods of solution. Prerequisite: ENGR 202 with a grade of C or better and MATH 266. S.

ME 428. Advanced Manufacturing Processes. 3 Credits.
Individual projects involving the manufacturing economics and flow charts for selected products and basic technical principles of manufacturing processes. Includes laboratory. Prerequisite: ME 418. On demand.

ME 429. Introduction to Finite Element Analysis. 3 Credits.
Finite element analysis is introduced as a design tool. Emphasis is given to modeling techniques and element types. Matrix methods are used throughout the class. Prerequisite: ENGR 203 with a grade of C or better. On demand.

ME 439. Introduction to Robotics. 3 Credits.
A systems engineering approach to robotics. Presents an introduction to manipulators, sensors, actuators, and end effectors for automation. Topics covered include kinematics, dynamics, control, programming of manipulators, pattern recognition, and computer vision. Prerequisite: ENGR 200 with a grade of C or better and MATH 166 with a grade of C or better. On demand.

ME 446. Gas Turbines. 3 Credits.
General principles, thermodynamics, and performance of gas turbine engines. Design consideration of engine components. Prerequisite: ME 341 with a grade of C or better. On demand.

ME 449. Internal Combustion Engines. 3 Credits.
Fundamentals of spark ignition and compression ignition engines, related components and processes. Prerequisite: ME 341 with a grade of C or better. On demand.

ME 451. Heating and Air Conditioning. 3 Credits.
Psychometrics, heating and cooling loads and analysis of air conditioning systems. Prerequisite: ME 341 with a grade of C or better and ME 306. On demand.

ME 464. Computational Fluid Dynamics. 3 Credits.
Computational fluid dynamics (CFD) is an introductory course focused on the numerical solution of partial differential equations (PDEs) using finite difference and finite volume methods. The course topics include the governing equations in fluid dynamics, classification of PDEs, boundary and initial conditions of PDEs, numerical discretization methods, analysis of numerical methods, model equations for incompressible and compressible flows, numerical methods suitable for model equations, and numerical linear algebra. Advanced topics in grid generation and turbulence modeling, important to practical applications of CFD, will also be discussed. Prerequisite: ME 341 with a grade of C or better, ME 306, and MATH 266. On demand.

ME 466. Aerodynamics. 3 Credits.
This is a course on the fundamentals of aerodynamics for engineers. The course will cover a review of fluid mechanics including inviscid, incompressible, and compressible flows. The course topics include parameters for airfoils and wings, incompressible flow over airfoils and wings of infinite and finite span, shock and expansion waves, quasi-one-dimensional compressible flow through nozzle, subsonic compressible flow over airfoils, supersonic flow over thin airfoils, introduction to viscous flow, and laminar and turbulent boundary layers. Prerequisite: ME 341 with a grade of C or better and ME 306. S.

ME 474. Fundamentals of Heat and Mass Transfer. 3 Credits.
Convection, conduction, radiation, dimensional analysis and design of heat transfer equipment. Prerequisite: ME 341 with a grade of C or better, ME 306, and MATH 266. S.

ME 476. Intermediate Fluid Mechanics. 3 Credits.
Differential forms of conservation of mass, energy, and momentum for viscous fluid flow. Boundary layer theory and its applications. Principles of one-dimensional compressible flow. Prerequisite: ME 341 with a grade of C or better, ME 306, and MATH 266. On demand.

ME 477. Compressible Fluid Flow. 3 Credits.
Introduction to the theory and application of one-dimensional compressible flow. Course topics include isentropic flow in converging and converging/diverging nozzles, normal shock waves, oblique shock waves, Prandtl-Meyer flow, flow with friction and heat addition. Prerequisite: ME 341 with a grade of C or better and ME 306. On demand.

ME 480. Mechanical Engineering Seminar. 3 Credits.
Reports and presentations on current developments in mechanical engineering and engineering ethics. Prerequisite: ENGL 130 with a grade of C or better and ME Senior standing. Corequisite: ME 487. F.

ME 483. Mechanical Measurements Laboratory. 3 Credits.
Experiments and written reports on the operation and performance of instruments and basic mechanical engineering equipment. Prerequisite: ENGL 130 with a grade of C or better and ENGR 206. F.

ME 484. Ground Vehicle Dynamics. 3 Credits.
ME 484 is a junior and senior level elective course. This course deals with the design of ground vehicle suspension and steering systems. Vehicle ride, handling and safety systems are covered along with passive and active suspension control. Prerequisite: ME 322. On demand.

ME 485. Multiphysics Modeling. 3 Credits.
Theory and techniques of modeling coupled thermal, fluid, mechanical, and/or electrical fields in components design. The focus is on the fundamental techniques used to simultaneously derive and solve coupled equations and the use of commercial multi physics finite element software. Prerequisite: ME 323. S.

ME 487. Engineering Design. 2 Credits.
The first course of a two-course sequence in Engineering Design, students will establish important features of the machine or system to be designed, perform market analysis, establish design objectives, explore alternatives, conduct research, specify constraints. Prerequisite: ME 323, ME 323L, ME 474 or any one elective from the thermal science group. Corequisite: ENGR 460, ME 301, and ME 483. F.

ME 488. Engineering Design. 3 Credits.
Systematic study and practice essential to the optimal design of a complete machine or system, utilizing economic and social constraints together with current mechanical and thermal design techniques. The course is a continuation of ME 487 taken the preceding semester. Prerequisite: ME 487. S.

ME 489. Senior Honors Thesis. 1-8 Credits.
Supervised independent study culminating in a thesis. Prerequisite: Consent of the Department and approval of the Honors Committee. Repeatable to 9.00 credits. F,S.

ME 490. Special Laboratory Problems. 1-3 Credits.
Laboratory investigations of interest to students and faculty. Repeatable to maximum of 6 credits. Prerequisite: Consent of instructor. Repeatable to 6.00 credits. On demand.

ME 497. Internship. 1-8 Credits.
A practical internship experience with an employer closely associated with the student's academic area. Arranged by mutual agreement among student, department and employer. Formal application and/or interview to internship site is required. A total of 120 hours of internship experience is required over the course of the semester for 1 credit of ME 497. Prerequisite: ENGR 202 with a grade of C or better and ENGR 203 with a grade of C or better. F,S,SS.

Aerospace Engineering

AE 423. Aerospace Structures. 3 Credits.
A fundamental course in aerospace structures for engineers. Topics include aerospace materials, thin-walled structures analysis, aircraft components stress analysis, airworthiness, airframe loads, structural instability, and aeroelasticity. Prerequisite: ENGR 203 with a grade of C or better. F.

AE 424. Flight Dynamics and Control. 3 Credits.
A course focused on flight dynamics control of rigid vehicle. The course begins with the equations of motion for rigid vehicle, basic aerodynamics of lifting surfaces, and forces and moments on the vehicle. Analysis of quasi-steady flight, linear modeling, and feedback stability augmentation are covered in the second part of the course. Prerequisite: ENGR 200 with a grade of C or better, ENGR 202 with a grade of C or better, MATH 266, and ME 306. S.

AE 483. Aeromechanics Laboratory. 4 Credits.
Experimental methods for aerospace-related measurements. Wind tunnel experiments with pressure, velocity, and force measurements. Computerized data acquisition and uncertainty analysis. Flight handling experience through flight simulators. Prerequisite: ENGR 202 with a grade of C or better, ENGR 203 with a grade of C or better, ENGR 206, and ME 306. S.