# Mechanical Engineering (MEEG)

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The mechanical engineering program is designed to offer a high-quality course of instruction involving classroom, laboratory, and extracurricular activities that results in graduates who are qualified and prepared to meet the demands of a professional career in the present and future work place and be able to assume a responsible place of leadership in a complex technological society.

The mission of the department is three-fold:

- Teaching — To provide a high-quality educational experience for undergraduate and graduate students that enables them to become leaders in their chosen professions.
- Research — To create, explore, and develop innovations in engineering and science through undergraduate and graduate research.
- Service — To provide beneficial service to the local, state, national, and international industries and communities via educational, technical, entrepreneurial, and professional activities.

The courses offered in mechanical engineering provide the student with a broad understanding of fundamental scientific principles that serve as a background for many fields of specialization. The undergraduate curriculum is designed to stress basic engineering principles and to assist in developing creative thinking. Emphasis is placed on the science and art of designing machines and systems, of converting energy into useful forms, and developing a basic understanding of engineering mechanics.

Completion of the degree requirements provides graduates with the following learning outcomes and ability to:

- Identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics;
- 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;
- Communicate effectively with a range of audiences;
- 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;
- Function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives;
- Develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions; and Student Graduation; and,
- Acquire and apply new knowledge as needed, using appropriate learning strategies.

The BSME Program Educational Objectives are to produce graduates who, within a few years of graduation, are expected to:

1. Contribute to the economic development of Arkansas and the world through the practice of Mechanical Engineering;
2. Meet or exceed the needs and expectations of mechanical engineering employers in industry, government, and private practice;
3. Engage in professional activities that promote the mechanical engineering profession and provide continuing self-development, and develop leadership potential;
4. Succeed in graduate study and research, if pursued; and
5. Become licensed professional engineers, if pursued.

## Requirements for B.S. in Mechanical Engineering

**Requirements for the B.S.M.E.:** The Bachelor of Science in Mechanical Engineering curriculum includes, in addition to the required 18 hours of history, government, fine arts/humanities/social science elective courses, a total of 12 hours of technical and science electives. A student must select all electives with the approval of his or her adviser. The fine arts/humanities/social science electives must be selected from the State Minimum Core (http://catalog.uark.edu/undergraduatecatalog/gened/stateminimum/) in the Academic Regulations chapter for university requirements for the program. It is expected that technical and science electives will be chosen to provide a coherent program within one or more areas of specialization or options available to mechanical engineers. Traditional areas of specialization are available in mechanical systems, materials, and energy systems. Other areas include pre-medical, management, and aerospace.

The first-year curriculum is essentially the same as prescribed for all engineering freshmen. Students entering the mechanical engineering program are required to take two, four hour laboratory based science electives. One of the four hour science electives must be PHYS 2074. The other four hour science elective must be chosen from one of the following:

| | | |
|---|---|---|
| ASTR 2003 & ASTR 2001L | Survey of the Universe (ACTS Equivalency = PHSC 1204 Lecture) and Survey of the Universe Laboratory (ACTS Equivalency = PHSC 1204 Lab) | 4 |
| BIOL 1543 & BIOL 1541L | Principles of Biology (ACTS Equivalency = BIOL 1014 Lecture) and Principles of Biology Laboratory (ACTS Equivalency = BIOL 1014 Lab) | 4 |
| BIOL 2213 & BIOL 2211L | Human Physiology (ACTS Equivalency = BIOL 2414 Lecture) and Human Physiology Laboratory (ACTS Equivalency = BIOL 2414 Lab) | 4 |

| | | |
|---|---|---|
| CHEM 1123 & CHEM 1121L | University Chemistry II (ACTS Equivalency = CHEM 1424 Lecture) and University Chemistry II Laboratory (ACTS Equivalency = CHEM 1424 Lab) | 4 |
| GEOS 1113 & GEOS 1111L | Physical Geology (ACTS Equivalency = GEOL 1114 Lecture) and Physical Geology Laboratory (ACTS Equivalency = GEOL 1114 Lab) | 4 |
| PHYS 2094 | University Physics III | 4 |
| PHYS 3544 | Optics | 4 |
| PHYS 3613 & PHYS 361VL | Modern Physics and Modern Physics Laboratory | 4 |

## Fine Arts/Humanities/Social Science Electives

Students must follow the University Core curriculum in selecting their history, government, fine arts, humanities, and social science electives. Each student in the College of Engineering is required to complete 18 semester hours in the humanities and social sciences.

The courses taken must include:

| | | |
|---|---|---|
| HIST 2003 | History of the American People to 1877 (ACTS Equivalency = HIST 2113) | 3 |
| or HIST 2013 | History of the American People, 1877 to Present (ACTS Equivalency = HIST 2123) | |
| or PLSC 2003 | American National Government (ACTS Equivalency = PLSC 2003) | |
| ECON 2143 | Basic Economics: Theory and Practice | 3 |
| or ECON 2013 | Principles of Macroeconomics (ACTS Equivalency = ECON 2103) | |
| CLST 1003 | Introduction to Classical Studies: Greece | 3 |
| or CLST 1003H | Honors Introduction to Classical Studies: Greece | |
| or CLST 1013 | Introduction to Classical Studies: Rome | |
| or PHIL 2003 | Introduction to Philosophy (ACTS Equivalency = PHIL 1103) | |
| or PHIL 2103 | Introduction to Ethics (ACTS Equivalency = PHIL 1003) | |
| or PHIL 2103C | Introduction to Ethics (ACTS Equivalency = PHIL 1003) | |

The remaining three courses must be selected from an approved list. The humanities and social sciences chart from the State Minimum Core (http://catalog.uark.edu/undergraduatecatalog/gened/stateminimum/) page should be used as a guide for selecting these courses.

## Mechanical Engineering Concentration Electives

The purpose of technical/science electives is to provide students with the opportunity to expand their education along lines of particular interest to them.

As part of the mechanical engineering curriculum, students are required to complete 12 hours of technical/science electives. These electives can be categorized into three groups: Mechanical Engineering Electives, Other Engineering Electives, and Science-Math Electives.

1. Mechanical Engineering Electives. All mechanical engineering courses at or above the 4000 level not already required in the BSME curriculum are acceptable. Special Project courses, MEEG 491V, are allowed as electives only after approval in advance by the department head.
2. Other Engineering Electives. The rules governing the selection of engineering electives are:
   Engineering or Computer Science/Computer Engineering courses at or above the 3000 level not already required in the BSME curriculum are allowed as technical-science electives. Courses with content remedial to required courses are not allowed, and courses considered redundant to required courses are not allowed.
3. Science-Math Electives. The approved list of science and math courses accepted as technical-science electives is available HERE (https://mechanical-engineering.uark.edu/Academics/undergraduate-students/forms-and-resources/).

## Mechanical Engineering B.S.M.E. Eight-Semester Degree Program

The following section contains the list of courses required for the Bachelor of Science in Mechanical Engineering degree and a suggested sequence. Not all courses are offered every semester, so students who deviate from the suggested sequence must pay careful attention to course scheduling and course prerequisites. Students interested in obtaining a sequencing schedule of courses may contact the Mechanical Engineering office.

Students wishing to follow the eight-semester degree plan should see the Eight-Semester Degree Policy (http://catalog.uark.edu/undergraduatecatalog/academicregulations/eightsemesterdegreecompletionpolicy/) in the Academic Regulations chapter for university requirements of the program.

Either the science elective in the second semester of Year 1 or the science elective in the first semester of Year 2 must include PHYS 2074. Other science electives should be chosen from an approved list. See the mechanical engineering office.

| First Year | Units | |
|---|---|---|
| | Fall | Spring |
| ENGL 1013 Composition I (ACTS Equivalency = ENGL 1013) (Satisfies General Education Outcome 1.1) | 3 | |
| CHEM 1103 University Chemistry I (ACTS Equivalency = CHEM 1414 Lecture) | 3 | |
| MATH 2554 Calculus I (ACTS Equivalency = MATH 2405) (Satisfies General Education Outcome 2.1)[1] | 4 | |
| GNEG 1111 Introduction to Engineering I | 1 | |
| Select one of the following (Satisfies General Education Outcome 4.2): | 3 | |
| HIST 2003 History of the American People to 1877 (ACTS Equivalency = HIST 2113) | | |
| HIST 2013 History of the American People, 1877 to Present (ACTS Equivalency = HIST 2123) | | |
| PLSC 2003 American National Government (ACTS Equivalency = PLSC 2003) | | |
| GNEG 1121 Introduction to Engineering II | | 1 |
| MATH 2564 Calculus II (ACTS Equivalency = MATH 2505) | | 4 |
| Freshman Science Elective (See Above) (Satisfies General Education Outcome 3.4)[2] | | 4 |

| | | |
|---|---|---|
| ENGL 1033 Technical Composition II (ACTS Equivalency = ENGL 1023) (Satisfies General Education Outcome 1.2) | | 3 |
| PHYS 2054 University Physics I (ACTS Equivalency = PHYS 2034) | | 4 |
| Year Total: | 14 | 16 |

| Second Year | Units | |
|---|---|---|
| | Fall | Spring |
| MEEG 2101 Computer-aided Design | 1 | |
| Science Elective (See Note Above) | 4 | |
| MATH 2574 Calculus III (ACTS Equivalency = MATH 2603) | 4 | |
| MEEG 2303 Introduction to Materials | 3 | |
| MEEG 2003 Statics | 3 | |
| MATH 2584 Elementary Differential Equations | | 4 |
| MEEG 2013 Dynamics | | 3 |
| MEEG 2403 Thermodynamics | | 3 |
| MEEG 2703 Computer Methods in Mechanical Engineering | | 3 |
| MEEG 2103 Introduction to Machine Analysis | | 3 |
| Year Total: | 15 | 16 |

| Third Year | Units | |
|---|---|---|
| | Fall | Spring |
| MEEG 3013 Mechanics of Materials | 3 | |
| MEEG 3113 Fundamentals of Vibrations | 3 | |
| MEEG 3202L Mechanical Engineering Laboratory I | 2 | |
| MEEG 3503 Mechanics of Fluids | 3 | |
| ELEG 3903 Electric Circuits and Machines | 3 | |
| ECON 2013 Principles of Macroeconomics (ACTS Equivalency = ECON 2103) (Satisfies General Education Outcome 3.3)<br>or ECON 2143 Basic Economics: Theory and Practice | 3 | |
| MEEG 3212L Mechanical Engineering Laboratory II | | 2 |
| MEEG 4413 Heat Transfer | | 3 |
| MEEG 4103 Machine Element Design | | 3 |
| MEEG 3223 Introduction to Mechatronics | | 3 |
| Technical/Science Elective | | 3 |
| Humanities State Minimum Core Elective (Satisfies General Education Outcomes 3.2 and 5.1):<br>CLST 1003 Introduction to Classical Studies: Greece<br>or CLST 1003H Honors Introduction to Classical Studies: Greece<br>or CLST 1013 Introduction to Classical Studies: Rome<br>or PHIL 2003 Introduction to Philosophy (ACTS Equivalency = PHIL 1103)<br>or PHIL 2103 Introduction to Ethics (ACTS Equivalency = PHIL 1003)<br>or PHIL 2103C Introduction to Ethics (ACTS Equivalency = PHIL 1003) | | 3 |
| Year Total: | 17 | 17 |

| Fourth Year | Units | |
|---|---|---|
| | Fall | Spring |
| MEEG 4132 Professional Engineering Practices | 2 | |
| MEEG 4182 Creative Project Design I | 2 | |
| MEEG 4202L Mechanical Engineering Laboratory III | 2 | |
| MEEG 4483 Thermal Systems Analysis and Design | 3 | |
| Technical/Science Elective | 3 | |
| Fine Arts State Minimum Core Elective (Satisfies General Education Outcome 3.1)[3] | 3 | |
| MEEG 4192 Creative Project Design II (Satisfies General Education Outcome 6.1) | | 2 |
| Two Technical/Science Elective | | 6 |
| Social Sciences State Minimum Core Elective (Satisfies General Education Outcome 3.3)[4] | | 3 |
| Social Sciences State Minimum Core Elective (Satisfies General Education Outcomes 3.3 and 4.1)[5] | | 3 |
| Year Total: | 15 | 14 |

| | |
|---|---|
| **Total Units in Sequence:** | **124** |

1 Students have demonstrated successful completion of the learning indicators identified for learning outcome 2.1, by meeting the prerequisites for MATH 2554.

2 The Freshman Science Elective courses that satisfy General Education Outcome 3.4 include: ASTR 2003/ASTR 2001L, BIOL 1543/BIOL 1541L, BIOL 2213/BIOL 2211L, CHEM 1123/CHEM 1121L, GEOS 1113/GEOS 1111L.

3 The Fine Arts Elective courses that satisfy General Education Outcome 3.1 include: ARCH 1003, ARHS 1003, COMM 1003, DANC 1003, LARC 1003, MLIT 1003, MLIT 1003H, MLIT 1013, MLIT 1013H, MLIT 1333, THTR 1003, THTR 1013, or THTR 1013H.

4 The Social Sciences Elective courses which satisfy General Education Outcome 3.3 include: AGEC 1103, AGEC 2103, ANTH 1023, COMM 1023, ECON 2013, ECON 2023, ECON 2143, EDST 2003, HDFS 1403, HDFS 2413, HDFS 2603, HIST 1113, HIST 1113H, HIST 1123, HIST 1123H, HIST 2003, HIST 2013, HIST 2093, HUMN 1114H, HUMN 2114H, INST 2813, INST 2813H, PLSC 2003,PLSC 2013, PLSC 2203, PLSC 2813, PLSC 2813H, PSYC 2003, RESM 2853, SOCI 2013, SOCI 2013H, or SOCI 2033. Note, courses cannot be counted twice in degree requirements.

5 The Social Sciences Elective courses which satisfy General Education Outcomes 3.3 and 4.1 include: ANTH 1023, COMM 1023, HDFS 1403, HDFS 2413, HIST 1113,HIST 1113H, HIST 1123, HIST 1123H, HIST 2093, HUMN 1114H, HUMN 2114H, INST 2813, INST 2813H, PLSC 2013, PLSC 2813, PLSC 2813H, RESM 2853, SOCI 2013, SOCI 2013H, or SOCI 2033.

## B.S. in Mechanical Engineering with Aerospace Concentration

**Requirements for the B.S.M.E.:** The Bachelor of Science in Mechanical Engineering curriculum includes, in addition to the required 18 hours of history, government, fine arts/humanities/social science elective courses, a total of 12 hours of technical and science electives. A student must select all electives with the approval of his or her adviser. The fine arts/

humanities/social science electives must be selected from the State Minimum Core (http://catalog.uark.edu/undergraduatecatalog/gened/stateminimum/) in the Academic Regulations chapter for university requirements for the program. It is expected that technical and science electives will be chosen to provide a coherent program within one or more areas of specialization or options available to mechanical engineers. Traditional areas of specialization are available in mechanical systems, materials, and energy systems. Other areas include pre-medical, management, and aerospace.

The first-year curriculum is essentially the same as prescribed for all engineering freshmen. Students entering the mechanical engineering program are required to take two, four hour laboratory based science electives. One of the four hour science electives must be PHYS 2074. The other four hour science elective must be chosen from one of the following:

| | | |
|---|---|---|
| ASTR 2003 & ASTR 2001L | Survey of the Universe (ACTS Equivalency = PHSC 1204 Lecture) and Survey of the Universe Laboratory (ACTS Equivalency = PHSC 1204 Lab) | 4 |
| BIOL 1543 & BIOL 1541L | Principles of Biology (ACTS Equivalency = BIOL 1014 Lecture) and Principles of Biology Laboratory (ACTS Equivalency = BIOL 1014 Lab) | 4 |
| BIOL 2213 & BIOL 2211L | Human Physiology (ACTS Equivalency = BIOL 2414 Lecture) and Human Physiology Laboratory (ACTS Equivalency = BIOL 2414 Lab) | 4 |
| CHEM 1123 & CHEM 1121L | University Chemistry II (ACTS Equivalency = CHEM 1424 Lecture) and University Chemistry II Laboratory (ACTS Equivalency = CHEM 1424 Lab) | 4 |
| GEOS 1113 & GEOS 1111L | Physical Geology (ACTS Equivalency = GEOL 1114 Lecture) and Physical Geology Laboratory (ACTS Equivalency = GEOL 1114 Lab) | 4 |
| PHYS 2094 | University Physics III | 4 |
| PHYS 3544 | Optics | 4 |
| PHYS 3613 & PHYS 361VL | Modern Physics and Modern Physics Laboratory | 4 |

## Fine Arts/Humanities/Social Science Electives

Students must follow the University Core curriculum in selecting their history, government, fine arts, humanities, and social science electives. Each student in the College of Engineering is required to complete 18 semester hours in the humanities and social sciences.

The courses taken must include:

| | | |
|---|---|---|
| HIST 2003 | History of the American People to 1877 (ACTS Equivalency = HIST 2113) | 3 |
| or HIST 2013 | History of the American People, 1877 to Present (ACTS Equivalency = HIST 2123) | |
| or PLSC 2003 | American National Government (ACTS Equivalency = PLSC 2003) | |
| ECON 2143 | Basic Economics: Theory and Practice | 3 |
| or ECON 2013 | Principles of Macroeconomics (ACTS Equivalency = ECON 2103) | |
| CLST 1003 | Introduction to Classical Studies: Greece | 3 |
| or CLST 1003H | Honors Introduction to Classical Studies: Greece | |
| or CLST 1013 | Introduction to Classical Studies: Rome | |
| or PHIL 2003 | Introduction to Philosophy (ACTS Equivalency = PHIL 1103) | |
| or PHIL 2103 | Introduction to Ethics (ACTS Equivalency = PHIL 1003) | |
| or PHIL 2103C | Introduction to Ethics (ACTS Equivalency = PHIL 1003) | |

The remaining three courses must be selected from an approved list. The humanities and social sciences chart from the State Minimum Core (http://catalog.uark.edu/undergraduatecatalog/gened/stateminimum/) page should be used as a guide for selecting these courses.

**Requirements for Aerospace Concentration:** The Aerospace Concentration in Mechanical Engineering provides students an opportunity to concentrate on engineering and scientific issues associated with aircraft, spacecraft, and space exploration. The Aerospace Concentration consists of the 112-credit hour Mechanical Engineering B.S. core and 12 hours of specified elective courses.

| | | |
|---|---|---|
| Choose at least two of the following courses: | | 6 |
| MEEG 4503 | Introduction to Flight | |
| MEEG 4523 | Astronautics | |
| MEEG 4433 | Aerospace Propulsion | |
| MEEG 5503 | Advanced Fluid Dynamics I | |
| MEEG 5533 | Fundamentals of Aerodynamics | |
| Choose an additional 6 hours from any of the above courses not yet taken or any following technical elective: | | 6 |
| MEEG 4903H | Honors Mechanical Engineering Research | |
| MEEG 491V | Special Topics in Mechanical Engineering | |
| MEEG 492V | Individual Study in Mechanical Engineering | |
| MEEG 5473 | Radiation Heat Transfer | |
| ASTR 4033 | Astrophysics I: Stars and Planetary Systems | |
| ASTR 4043 | Astrophysics II: Galaxies and the Large-Scale Universe | |
| GEOS 3213 | Principles of Remote Sensing | |
| SPAC 5033 | Astrophysics I: Stars and Planetary Systems | |

## B.S.M.E. with Aerospace Concentration Eight-Semester Plan

| First Year | Units | |
|---|---|---|
| | Fall | Spring |
| ENGL 1013 Composition I (ACTS Equivalency = ENGL 1013) | 3 | |
| CHEM 1103 University Chemistry I (ACTS Equivalency = CHEM 1414 Lecture) | 3 | |
| PHYS 2054 University Physics I (ACTS Equivalency = PHYS 2034) | 4 | |
| MATH 2554 Calculus I (ACTS Equivalency = MATH 2405) | 4 | |
| GNEG 1111 Introduction to Engineering I | 1 | |
| Select one of the following: | | 3 |
| HIST 2003 History of the American People to 1877 (ACTS Equivalency = HIST 2113) | | |
| HIST 2013 History of the American People, 1877 to Present (ACTS Equivalency = HIST 2123) | | |

| | | |
|---|---|---|
| PLSC 2003 American National Government (ACTS Equivalency = PLSC 2003) | | |
| GNEG 1121 Introduction to Engineering II | | 1 |
| MATH 2564 Calculus II (ACTS Equivalency = MATH 2505) | | 4 |
| ENGL 1023 Composition II (ACTS Equivalency = ENGL 1023) | | 3 |
| Freshman Science Elective, select one of the following: | | 4 |
| ASTR 2003 Survey of the Universe (ACTS Equivalency = PHSC 1204 Lecture) & ASTR 2001L Survey of the Universe Laboratory (ACTS Equivalency = PHSC 1204 Lab) | | |
| BIOL 1543 Principles of Biology (ACTS Equivalency = BIOL 1014 Lecture) & BIOL 2211L Human Physiology Laboratory (ACTS Equivalency = BIOL 2414 Lab) | | |
| BIOL 2213 Human Physiology (ACTS Equivalency = BIOL 2414 Lecture) & BIOL 2211L Human Physiology Laboratory (ACTS Equivalency = BIOL 2414 Lab) | | |
| CHEM 1123 University Chemistry II (ACTS Equivalency = CHEM 1424 Lecture) & CHEM 1121L University Chemistry II Laboratory (ACTS Equivalency = CHEM 1424 Lab) | | |
| GEOS 1113 Physical Geology (ACTS Equivalency = GEOL 1114 Lecture) & GEOS 1111L Physical Geology Laboratory (ACTS Equivalency = GEOL 1114 Lab) | | |
| PHYS 2094 University Physics III | | |
| PHYS 3544 Optics | | |
| Year Total: | 15 | 15 |

| Second Year | Fall | Spring |
|---|---|---|
| MATH 2574 Calculus III (ACTS Equivalency = MATH 2603) | 4 | |
| PHYS 2074 University Physics II (ACTS Equivalency = PHYS 2044 Lecture) | 4 | |
| MEEG 2003 Statics | 3 | |
| MEEG 2101 Computer-aided Design | 1 | |
| MEEG 2303 Introduction to Materials | 3 | |
| MATH 2584 Elementary Differential Equations | | 4 |
| MEEG 2013 Dynamics | | 3 |
| MEEG 2103 Introduction to Machine Analysis | | 3 |
| MEEG 2403 Thermodynamics | | 3 |
| MEEG 2703 Computer Methods in Mechanical Engineering | | 3 |
| Year Total: | 15 | 16 |

| Third Year | Fall | Spring |
|---|---|---|
| ELEG 3903 Electric Circuits and Machines | 3 | |
| ECON 2013 Principles of Macroeconomics (ACTS Equivalency = ECON 2103) or ECON 2143 Basic Economics: Theory and Practice | 3 | |
| MEEG 3013 Mechanics of Materials | 3 | |
| MEEG 3113 Fundamentals of Vibrations | 3 | |
| MEEG 3202L Mechanical Engineering Laboratory I | 2 | |
| MEEG 3503 Mechanics of Fluids | 3 | |
| ELEG 3933 Circuits & Electronics | | 3 |
| PHIL 3103 Ethics and the Professions | | 3 |
| MEEG 3212L Mechanical Engineering Laboratory II | | 2 |
| MEEG 4103 Machine Element Design | | 3 |
| MEEG 4413 Heat Transfer | | 3 |
| Aerospace Technical Science Elective | | 3 |
| Year Total: | 17 | 17 |

| Fourth Year | Fall | Spring |
|---|---|---|
| MEEG 4182 Creative Project Design I | 2 | |
| MEEG 4132 Professional Engineering Practices | 2 | |
| MEEG 4202L Mechanical Engineering Laboratory III | 2 | |
| MEEG 4483 Thermal Systems Analysis and Design | 3 | |
| Fine Arts Elective (from University Core list) | 3 | |
| Aerospace Technical Science Elective | 3 | |
| MEEG 4192 Creative Project Design II | | 2 |
| Social Science Elective (from University Core List) | | 3 |
| Social Science Elective (from University Core List) | | 3 |
| Aerospace Technical Science Elective | | 3 |
| Aerospace Technical Science Elective | | 3 |
| Year Total: | 15 | 14 |

**Total Units in Sequence: 124**

**Almahakeri, Mohamed,** Ph.D., M.S.M.E. (Queen's University), Teaching Assistant Professor, 2020.

**Davis, James Allen,** Ph.D., M.S.M.E., B.S.M.E. (University of Arkansas), Teaching Assistant Professor, 1997, 2018.

**Hamilton, John H.,** M.S., B.S. (University of Arkansas), Instructor, 2002.

**Hu, Han,** Ph.D. (Drexel University), Assistant Professor, 2019, .

**Huang, Po-Hao Adam,** Ph.D., M.S., B.S. (University of California-Los Angeles), Associate Professor, 2006, 2012.

**Huitink, David,** Ph.D., M.S.M.E., B.S.M.E. (Texas A&M University), Associate Professor, 2016, 2022.

**Jensen, David C.,** Ph.D., M.S., B.S. (Oregon State University), Associate Professor, Twenty-First Century Professorship, 2012, 2018.

**Leylek, Jim,** Ph.D. (University of Illinois-Urbana-Champaign), M.S., B.S. (University of Illinois at Chicago), Professor, 2011.

**Meng, Xiangbo,** Ph.D. (University of Western Ontario), M.S.E.E. (China University of Petroleum), B.S.C.E. (Northwestern University), Associate Professor, 2016, 2022.

**Millett, Paul,** Ph.D., M.S. (University of Arkansas), B.E. (Vanderbilt University), Associate Professor, Twenty-First Century Professor, 2013, 2019.

**Nair, Arun,** Ph.D. (Virginia Polytechnic State University), M.S. (Colorado State University), B.T. (Mahatma Gandhi University), Associate Professor, 2013, 2019.
**Nutter, Darin W.,** Ph.D. (Texas A&M University), M.S.M.E., B.S.M.E. (Oklahoma State University), Professor, Twenty-First Century Leadership Chair in Engineering, 1994, 2012.
**Roberts, Monty,** M.S., B.S. (University of Arkansas), Instructor, 2011.
**Roe, Larry,** Ph.D. (University of Florida), M.S., B.S.M.E. (University of Mississippi), Associate Professor, 1994, 2000.
**Shou, Wan,** Ph.D. (Missouri University of Science and Technology), M.S.M.E. (University of Louisiana at Lafayette), B.E. (Tianjin Polytechnic University), Assistant Professor, 2021.
**Tung, Steve,** Ph.D., M.S.M.E. (University of Houston), B.S.M.E. (National Taiwan University), Professor, 2000, 2013.
**Walter, Keith D.,** Ph.D., M.S., B.S. (Clemson University), Professor, 2021.
**Walters, D. Keith,** Ph.D., M.S.M.E., B.S.M.E. (Clemson University), Professor, 2021.
**Wejinya, Uchechukwu C.,** Ph.D., M.S., B.S. (Michigan State University), Associate Professor, Twenty-First Century Professor, 2008, 2014.
**Zhou, Wenchao,** Ph.D. (Georgia Institute of Technology), M.S.M.E. (Xi'an Jiaotong University, Xi'an, China), B.S.M.E. (Huazhong University of Science and Technology, Wuhan, China), Associate Professor, 2014, 2020.
**Zou, Min,** Ph.D., M.S.M.E. (Georgia Institute of Technology), M.S.A.E., B.S.A.E. (Northwestern Polytechnical University), Professor, Twenty-First Century Chair in Materials, Manufacturing and Integrated Systems, 2003, 2013.

## Courses

**MEEG 2003. Statics. 3 Hours.**
Equilibrium and resultants of force systems in a plane and in space; analysis of structures, friction, centroids, moments of inertia, and virtual work method. Methods of analysis are emphasized. Corequisite: Drill component. Pre- or Corequisite: MATH 2574 or MATH 2574C. Prerequisite: PHYS 2054. (Typically offered: Fall, Spring and Summer)

**MEEG 2013. Dynamics. 3 Hours.**
Kinematics and kinetics of particle and of rigid bodies; work and energy; impulse and momentum, and special topics. Corequisite: Drill component. Prerequisite: MEEG 2003 and MATH 2574. (Typically offered: Fall, Spring and Summer)

**MEEG 2101. Computer-aided Design. 1 Hour.**
The concept and application of solid-modeling, based on SolidWorks Computer-Aided Design (CAD) software suite, are introduced in this course. They include sketches, parts modeling, assembly of parts, and drawing documentation. Prerequisite: GNEG 1121 or GNEG 1121H or GNEG 1103. (Typically offered: Fall and Spring)

**MEEG 2103. Introduction to Machine Analysis. 3 Hours.**
Introduction to kinematics and kinetics of mechanisms, static and dynamic forces, gears and cam design and analysis. Recitation three hours per week and drill one hour per week. Corequisite: Drill component. Pre- or Corequisite: MEEG 2013. Prerequisite: PHYS 2054 and MEEG 2101. (Typically offered: Spring and Summer)

**MEEG 2303. Introduction to Materials. 3 Hours.**
A study of chemical, physical, and electrical properties of materials using fundamental atomistic approach. The materials of interest are: metals, polymers, ceramics, and composites. The interactive relationship between structure, properties, and processing of materials will be emphasized. For various engineering applications. Corequisite: Drill component. Prerequisite: MATH 2554, PHYS 2054 and CHEM 1103. (Typically offered: Fall and Spring)

**MEEG 2403. Thermodynamics. 3 Hours.**
A study of the 1st and 2nd laws of thermodynamics. Availability of energy, properties of liquids, gases, and vapors; nonflow and flow processes. Recitation 3 hours, drill 2 hours per week. Corequisite: Drill component. Prerequisite: PHYS 2054 and MATH 2564. (Typically offered: Fall, Spring and Summer)

**MEEG 2703. Computer Methods in Mechanical Engineering. 3 Hours.**
Use of computers and programming for solving engineering problems. Basic numerical methods including errors, equation solution, matrices, optimization, regression, integration, and differential equations. Corequisite: Drill component. Pre- or Corequisite: MATH 2584. (Typically offered: Spring and Summer)

**MEEG 3013. Mechanics of Materials. 3 Hours.**
Stress and deformation of members in tension, compression, torsion, and bending, and the design of these members. Columns, statically indeterminate beams, and simple connections. Corequisite: Drill component. Prerequisite: MEEG 2003. (Typically offered: Fall, Spring and Summer)

**MEEG 3013H. Honors Mechanics of Materials. 3 Hours.**
Stress and deformation of members in tension, compression, torsion, and bending, and the design of these members. Columns, statically indeterminate beams, and simple connections. Corequisite: Drill component. Prerequisite: MEEG 2003 and honors standing. (Typically offered: Fall, Spring and Summer)
This course is equivalent to MEEG 3013.

**MEEG 3113. Fundamentals of Vibrations. 3 Hours.**
Time and frequency domain mathematical techniques for linear system vibrations are reviewed. Undamped system and viscously damped systems are analyzed. Equations of motion of single and multiple degrees-of-freedom systems are studied. Vibration of multi-degree-of-freedom systems are analyzed using modal analysis and modal summation methods. Eigenvalue problems as related vibrations are studied. Corequisite: Drill component. Prerequisite: MEEG 2103, MATH 2584 or MATH 2584C, MEEG 2703, and MEEG 2013. (Typically offered: Fall and Spring)

**MEEG 3202L. Mechanical Engineering Laboratory I. 2 Hours.**
Introduction to measurement, uncertainty, data acquisition, and instrumentation with an emphasis in materials and manufacturing. Corequisite: Drill component. Pre- or Corequisite: MEEG 3013 and ELEG 3903. Prerequisite: MEEG 2303 and PHYS 2074. (Typically offered: Fall and Spring)

**MEEG 3212L. Mechanical Engineering Laboratory II. 2 Hours.**
Design and implementation of measurements, fabrication processes, data acquisition, and data analysis with emphasis in mechanical and fluid systems. Corequisite: Drill component. Prerequisite: MEEG 3202L, MEEG 3503 and MEEG 3113. (Typically offered: Fall and Spring)

**MEEG 3223. Introduction to Mechatronics. 3 Hours.**
This course is an introduction to design and control the mechatronic system, which requires integration of the mechanical and electrical knowledge within a unified framework. The topics covered in this course include basic electronics, diodes, transistors, power amplifiers, digital logic, operation amplifier, motor design, encoder, and programming in Arduino. Corequisite: Lab component. Prerequisite: MEEG 3202L. (Typically offered: Spring)

**MEEG 3503. Mechanics of Fluids. 3 Hours.**
A study of fluids including fluid properties, pressure, and flow fields utilizing conservation of mass, energy, and momentum principles. Prerequisite: MEEG 2403 or CHEG 2313. Pre- or Corequisite: MATH 2584. (Typically offered: Fall and Summer)

**MEEG 4003. Intermediate Dynamics. 3 Hours.**
Review of central-force motion of spacecraft, use of rotating reference frames, Coriolis acceleration. Kinematics of rigid bodies in 3-D space: velocities and accelerations in different moving reference frames, addition theorem of angular accelerations. Kinetics of rigid bodies in 3-D space: eigenvalues and eigenvectors of inertia matrices, momentum and kinetic energy of a rigid body in 3-D motion, Euler's equations of motion; precession, nutation, and spin of a gyroscope; forced steady precession, torque free steady precession, space cone, and body cone. Prerequisite: MEEG 2013. (Typically offered: Irregular)

**MEEG 4023. Composite Materials: Analysis and Design. 3 Hours.**
A study of fibrous composite materials with emphasis on mechanical behavior, synthesis, and application. Topics include macro- and micromechanical analysis lamina, lamina theory, failure analysis in design, and manufacturing techniques. Prerequisite: MEEG 3013. (Typically offered: Irregular)

**MEEG 4103. Machine Element Design. 3 Hours.**
This course introduces the static failure theories and fatigue failure theories, and how each of the theories can be applied in practical engineering problems in supporting the selection and design of machine elements. This course also introduces key design concepts, design principles, design process, and design guidelines for four commonly-used machine elements: spring, gear, bearing and shaft. Pre- or Corequisite: MEEG 3113. Prerequisite: MEEG 3013. (Typically offered: Fall, Spring and Summer)

**MEEG 4103H. Honors Machine Element Design. 3 Hours.**
This course introduces the static failure theories and fatigue failure theories, and how each of the theories can be applied in practical engineering problems in supporting the selection and design of machine elements. This course also introduces key design concepts, design principles, design process, and design guidelines for four commonly-used machine elements: spring, gear, bearing and shaft. Advanced project required of honors students. Advanced project required. (Typically offered: Fall, Spring and Summer)
This course is equivalent to MEEG 4103.

**MEEG 4123. Finite Element Methods I. 3 Hours.**
Introduction to the use of the finite element method in mechanical engineering analysis and design. Use of commercial software to solve thermal and mechanical problems. Pre- or Corequisite: MEEG 3013 and MEEG 4413. (Typically offered: Irregular)

**MEEG 4132. Professional Engineering Practices. 2 Hours.**
Design proposal preparation, design codes, professional ethics, engineering economics, and the role of the engineer in society. Pre- or Corequisite: MEEG 4103 or MEEG 4483. (Typically offered: Fall and Spring)

**MEEG 4143. Design for Safety. 3 Hours.**
This course provides an overview of safety engineering and a framework from which the students can evaluate and develop mechanical and thermal systems from a safety perspective. Pre- or Corequisite: MEEG 4413. Prerequisite: MEEG 3013. (Typically offered: Irregular)

**MEEG 4153. Fundamentals of Mechanical Design. 3 Hours.**
This class is designed to provide engineering students with a head start in industry as design engineers or working in an engineering related function. The course contents cover machine design and analysis experiences as related to working in industry and performing consulting work. Major topics include the design process, design procedures, fasteners, general design and numerous consulting experiences. A concept design exercise and two special design projects will be assigned to the students as homework. Prerequisite: MEEG 4103. (Typically offered: Fall)

**MEEG 4173. Model-Based Systems Design and Analysis. 3 Hours.**
This course provides students with an introduction into the two main approaches to understanding and designing complex engineered systems. First, the course covers the unique technical challenge of systems engineering and design of systems. Second, the course covers concepts, methods and tools related to "model-based systems design." This covers formal modeling of the information content of complex systems. The third portion of the course will focus on modeling the complex behavior of the systems. This is often described as dynamical systems modeling. Students will utilize the methods and tools presented in class to model a complex engineered system of their choice (with instructor approval). The classes will alternate between presenting modeling methods to the students and students demonstrating their system to the class utilizing those methods. Students may not receive credit for both MEEG 4173 and MEEG 5173. Prerequisite: MEEG 4103 or Instructor consent. (Typically offered: Spring Even Years)

**MEEG 4182. Creative Project Design I. 2 Hours.**
Students will select a capstone design project, and each student group will prepare a formal written proposal on their project for presentation to a panel of judges. This group project will be carried to completion in MEEG 4192. Corequisite: MEEG 4483. Prerequisite: MEEG 4103. (Typically offered: Fall and Spring)

**MEEG 4192. Creative Project Design II. 2 Hours.**
Students choose their capstone project from a list of approved engineering problems. During the course of two semesters, students will learn and apply the design process along with project management skills to deliver the solution on time and on budget as a team. For the first semester (CP1) the team will focus on design of the best solution and development of a complete engineering package necessary to move forward. In the final semester (CP2) the team will implement and test the performance of their solution. Prerequisite: MEEG 4182. (Typically offered: Fall and Spring)

**MEEG 4202L. Mechanical Engineering Laboratory III. 2 Hours.**
Application of measurement techniques to mechanical engineering problems which emphasize mechanical and thermal systems. Corequisite: Drill component. Pre- or corequisite: MEEG 4483. Prerequisite: MEEG 3212L and MEEG 4103. (Typically offered: Fall, Spring and Summer)

**MEEG 4213. Control of Mechanical Systems. 3 Hours.**
Mathematical modeling for feedback control of dynamic mechanical systems with design techniques using LaPlace transforms, state variables, root locus, frequency analysis, and criteria for performance and stability. Prerequisite: MEEG 3113. (Typically offered: Irregular)

**MEEG 4233. Microprocessors in Mechanical Engineering I: Electromechanical Systems. 3 Hours.**
Microcomputer architectural, programming, and interfacing. Smart product design (microprocessor-based design). Control of DC and stepper motors and interfacing to sensors. Applications to robotics and real-time control. Mobile robot project. Digital and analog electronics are reviewed where required. Prerequisite: ELEG 3903. (Typically offered: Irregular)

**MEEG 4253. Introduction to Robotics. 3 Hours.**
This course serves as an introduction to robotics. The course covers the historical development of robotics as a field, and as mechatronic systems, the importance of integrating sensors, actuators and end-effectors. Topics covered in this course will include but not limited to the following: mathematical modeling of robots, rigid motions and homogeneous transformation, forward/inverse kinematics, and velocity kinematics. Prerequisite: MEEG 2703, MEEG 3113 and instructor consent. (Typically offered: Fall)

**MEEG 4303. Materials Laboratory. 3 Hours.**
A study of properties, uses, testing, and heat treatment of basic engineering materials and related analytical techniques. Corequisite: Lab component. Prerequisite: MEEG 2303. (Typically offered: Irregular)

**MEEG 4313. Introduction to Tribology. 3 Hours.**
A study of science and technology of interacting surfaces in relative motion. Topics include solid surface characterization, contact between solid surfaces, adhesion, friction, wear, lubrication, micro/nanotribology, friction and wear screening test methods, and tribological components and applications. Prerequisite: MEEG 3013 and MEEG 3503 or graduate standing. (Typically offered: Irregular)

**MEEG 4323L. Nanotechnology Laboratory. 3 Hours.**
Provides students with hands-on experience in several major areas of nanotechnology, including nanoscale imaging, synthesis of nanomaterials, nanostructure assembly and manipulation, device and system integration, and performance evaluation. Students can earn credit for only one of the following courses: MEEG 4323L, BMEG 4103L, PHYS 4793L. Corequisite: Drill component, junior standing and instructor consent. Prerequisite: MATH 2564 and PHYS 2074. (Typically offered: Fall)

**MEEG 4323M. Honors Nanotechnology Laboratory. 3 Hours.**
Provides students with hands-on experience in several major areas of nanotechnology, including nanoscale imaging, synthesis of nanomaterials, nanostructure assembly and manipulation, device and system integration, and performance evaluation. Students can earn credit for only one of the following courses: MEEG 4323L, BMEG 4103L, PHYS 4793L. Corequisite: Drill component, junior standing and instructor consent. Prerequisite: MATH 2564 and PHYS 2074. (Typically offered: Fall)
This course is equivalent to MEEG 4323L.

**MEEG 4333. Hybrid Electric Vehicles. 3 Hours.**
This course is intended to provide an introduction to basics of hybrid and pure electrical vehicles (mainly passenger cars), covering history, architecture, constituents, working mechanisms, and key technologies. The course focuses on fundamental concepts of different hybrid electrical vehicles (HEVs) and their technical features and highlights the successes of the state-of-the-art pure electrical vehicles (EVs). In addition, this course will introduce various battery technologies used for electrical vehicles, covering traditional batteries, lithium-ion batteries, and batteries beyond lithium-ions. It is appropriate for engineering and natural science students interested in obtaining basic knowledge of hybrid and pure electrical vehicles to prepare for a career in developing alternate energy sources. Prerequisite: ELEG 3903 or BENG 3113, and senior standing. (Typically offered: Spring)

**MEEG 4413. Heat Transfer. 3 Hours.**
Basic thermal energy transport processes; conduction, convection, and radiation; and the mathematical analysis of systems involving these processes in both steady and time-dependent cases. Prerequisite: MEEG 3503. (Typically offered: Spring and Summer)

**MEEG 4423. Power Generation. 3 Hours.**
Study of design and operational aspects of steam, gas, and combined cycle power plants. Brief study of Nuclear and Alternative energy systems. Prerequisite: MEEG 3503. (Typically offered: Irregular)

**MEEG 4433. Aerospace Propulsion. 3 Hours.**
Principles, operation, and characteristics of gas turbine and rocket engines. Brief study of novel spacecraft propulsion systems. Prerequisite: MEEG 3503. (Typically offered: Irregular)

**MEEG 4453. Industrial Waste and Energy Management. 3 Hours.**
Applications of thermodynamics, heat transfer, fluid mechanics, and electric machinery to the analysis of waste streams and energy consumption for industrial facilities. Current techniques and technologies for waste minimization and energy conservation including energy-consuming systems and processes, utility rate analysis, economic analysis and auditing are taught. Prerequisite: MEEG 4413. (Typically offered: Irregular)

**MEEG 4473. Indoor Environmental Control. 3 Hours.**
Gives student a thorough understanding of the fundamental theory of air conditioning design for commercial buildings, including calculating heating and cooling loads along with the proper selection and sizing of air conditioning equipment. Prerequisite: MEEG 4413. (Typically offered: Irregular)

**MEEG 4483. Thermal Systems Analysis and Design. 3 Hours.**
Analysis design and optimization of thermal systems and components with examples from such areas as power generation, refrigeration, and propulsion, Availability loss characteristics of energy systems and availability conservation methods. Prerequisite: MEEG 4413. (Typically offered: Fall and Summer)

**MEEG 4483H. Honors Thermal Systems Analysis and Design. 3 Hours.**
Analysis design and optimization of thermal systems and components with examples from such areas as power generation, refrigeration, and propulsion. Availability loss characteristics of energy systems and availability conservation methods. Additional topics, with an additional design project and /or more rigorous approach to design projects for honors course. Advanced project required. Prerequisite: MEEG 4413 (Typically offered: Fall and Summer)
This course is equivalent to MEEG 4483.

**MEEG 4503. Introduction to Flight. 3 Hours.**
The course will provide understanding in basic aerodynamics, airfoil design and characteristics, and flight control surfaces. Prerequisite: MATH 2584, MEEG 3503. (Typically offered: Fall)

**MEEG 4503H. Honors Introduction to Flight. 3 Hours.**
The course will provide understanding in basic aerodynamics, airfoil design and characteristics, and flight control surfaces. Prerequisite: MATH 2584 and MEEG 3503. (Typically offered: Fall)
This course is equivalent to MEEG 4503.

**MEEG 4523. Astronautics. 3 Hours.**
Study of spacecraft design and operations. Prerequisite: MEEG 2013 and MEEG 2403 or consent of instructor. (Typically offered: Irregular)

**MEEG 4633. Additive Manufacturing. 3 Hours.**
This course provides an overview of developing opportunities and critical challenges of additive manufacturing (AM, also known as 3-D printing). It covers existing and emerging additive manufacturing processes in the context of product design, materials selection and processing, and industrial and consumer applications. Students will learn to take advantage of the new capabilities of additive manufacturing technologies (e.g., design freedom) for existing and new applications and the implementation of their designs in a laboratory through project-based learning. Students may not receive credit for both MEEG 4633 and MEEG 5633. Prerequisite: MEEG 2101, MEEG 2303, MEEG 3013, and MEEG 3503 or instructor consent. (Typically offered: Spring)

**MEEG 4703. Mathematical Methods in Engineering. 3 Hours.**
Determinants, matrices, inverse of a matrix, simultaneous equations, eigenvalues, eigenvectors, coordinate transformations for matrices, diagonalization, square roots of a matrix, cryptography, and method of least squares. Vector algebra and calculus, Green's theorem, Strokes' theorem, and Gauss' divergence theorem. Index notation, epsilon-delta identity, and Cartesian tensors. Curvilinear coordinates, base vectors, and covariant and contravariant tensors. Applications to mechanics. Prerequisite: MATH 2574. (Typically offered: Irregular)

**MEEG 4903H. Honors Mechanical Engineering Research. 3 Hours.**
Independent research for mechanical engineering honors students. Prerequisite: Honors standing and instructor consent. (Typically offered: Fall and Spring)

**MEEG 491V. Special Topics in Mechanical Engineering. 1-6 Hour.**
Consideration of current mechanical engineering topics not covered in other courses. (Typically offered: Fall, Spring and Summer) May be repeated for up to 6 hours of degree credit.

**MEEG 491VH. Honors Special Topics in Mechanical Engineering. 1-6 Hour.**
Consideration of current mechanical engineering topics not covered in other courses. Prerequisite: Honors standing. (Typically offered: Fall, Spring and Summer) May be repeated for up to 6 hours of degree credit.
This course is equivalent to MEEG 491V.

**MEEG 492V. Individual Study in Mechanical Engineering. 1-3 Hour.**
Individual study and research on a topic of mutually agreeable interest to the student and a faculty member. Prerequisite: Senior standing. (Typically offered: Fall, Spring and Summer)

**MEEG 492VH. Honors Individual Study in Mechanical Engineering. 1-3 Hour.**
Individual study and research on a topic of mutually agreeable interest to the student and a faculty member. Prerequisite: Senior standing. (Typically offered: Fall, Spring and Summer)
This course is equivalent to MEEG 492V.