Metallurgical Engineering

UNDERGRADUATE PROGRAM HANDBOOK 2025-2026

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Introduction

This guide is intended to help students understand the undergraduate program in Metallurgical Engineering at the University of Utah. This guide is a supplement to the University of Utah General Catalog or Bulletin, which remains the official document of the required program leading to a Bachelor of Science Degree in Metallurgical Engineering.

Brief Overview of Metallurgical Engineering

Metallurgical Engineering involves the study, design, implementation, and improvement of processes that transform rocks and minerals into metal and mineral products that make our lives better. Metallurgical engineering students take courses in: particle separation technology, which focuses on particle separation, processing, and recycling, and includes particle characterization, comminution, size separation, flotation, coal preparation, reme¬diation of nuclear materials, automatic control and process engineering of particles including metal powders, energy-related minerals, pigments, and ceramics; chemical metallurgy, which focuses on metal removal, processing, and recycling into a purified metal and includes heterogeneous reaction kinetics, transport phenomena, computer modeling, leaching, solution purification, ion exchange, solvent extraction, precipitation, roasting, reduction, smelting, iron¬making and steelmaking; and physical metallurgy, which focuses on metal casting, forming, joining, and metal property evaluation and optimization and includes phase trans-formations, powder metallurgy, metallography, functionally graded materials, com¬posites, magnetic materials, thin film processing, fatigue, positron annihilation, rapid solid¬ification, metal failure analysis, and corrosion. (For additional information, please see http://www.mse.utah.edu/.)

Accreditation

The Metallurgical Engineering Program is accredited by The Engineering Accreditation Commission of ABET (http://www.abet.org), 111 Market Place, Suite 1050, Baltimore, MD 21202-4012; Telephone: (410) 347-7700.

Mission Statement

The mission of the Metallurgical Engineering program at the University of Utah is to create an environment through teaching, research, and service that:

1. allows training of metallurgical engineering undergraduate and graduate students with the broad technical knowledge, critical thinking abilities, communication skills, social consciousness, and integrity necessary to become outstanding engineers and scientists in industry and academia,
2. facilitates generation of new knowledge, and
3. provides supporting service through consulting or other avenues to industry, government and general public.

The central theme of the program is the study of all aspects of metallic materials, from their initial recovery and production through their development, manufacture, and use. The primary academic goals of the program include undergraduate and graduate education as well as research training of undergraduate and graduate students. The program strives to produce graduates with the necessary breadth of technical skills in extraction, process and plant design, and development, characterization,

and manufacture of all metallic materials and components, that will make them strong competitors in the job market created by the mining, metallurgical, materials, manufacturing, and electronics industries. The program offers exceptional opportunities for graduate students to undertake research in a wide range of fields at a level that extends the frontiers of knowledge.

Program Educational Objectives

For the B.S degree in Metallurgical Engineering, the Program Educational Objectives are:

1. Graduates will be practicing professionals or engaged in graduate/advanced studies in metallurgical engineering or related areas.
2. Graduates will continue to expand their knowledge and capabilities and contribute effectively to their chosen profession and to society.
3. Graduates will demonstrate technical and interpersonal skills that promote success in their career.

Student Outcomes

The following student outcomes of the curriculum are assessed to meet Metallurgical Engineering B.S. Degree Program Educational Objectives

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.
8. An ability to understand structure, properties, processing, and performance relationships.

Financial Aid and Scholarship Information

The Department of Materials Science and Engineering offers a variety of scholarships. Students are encouraged to apply for these scholarships.

Students should submit applications through both the College of Engineering (https://www.coe.utah.edu/students/current/scholarships/) and the College of Mines and Earth Sciences (https://cmes.utah.edu/students/financial-aid.php). Students should also consider applying for other scholarships offered by professional societies, as well as general University of Utah scholarships. Student loans, grants, and need-based scholarships are also available through the financial aid office (https://financialaid.utah.edu/types-of-aid/scholarships/ checklist.php).

Career Opportunities

Metallurgical Engineers play a key role in the nation's well-being because of the importance of metals and minerals in modern society. The broad use of metals and mineral in our society leads to a wide array of job opportunities. Our graduates work for companies such as Lockheed-Martin, BHP Steel, Rio Tinto, Nucor Steel, Aker Kvaerner, Freeport McMoRan, Chevron, GSC Foundries, Westinghouse, US Nuclear Regulatory Commission, Boart Longyear, Barrick, 1M Flash Technologies, Williams International, Newmont Gold, IBM, National Semiconductor, MEMC Electronics, Fluor Daniel, Samsung, Parker Aerospace, Johnson Matthey, Idaho National Engineering and Environmental Laboratory, etc. The average starting salary for students graduating with a bachelor's degree in Metallurgical Engineering is approximately $60,000/yr. Job placement for metallurgical engineers is typically near 100%.

Undergraduate Metallurgical Engineering Courses

See also university catalog at https://catalog.utah.edu/#/home

MET E 1630 (3) - Introduction to Metallurgical Engineering
MET E 3610 (3) - Metallurgical Thermodynamics I
MET E 3630 (3) - Metallurgical Thermodynamics II
MET E 5260 (3) - Physical Metallurgy I
MET E 5450 (3) - Mechanical Behavior of Metals
MET E 5670 (3) - Mineral Processing I
MET E 5700 (3) - Low Temperature Chemical Processing
MET E 5710 (4) - High-Temperature Chemical Processing
MET E 5760 (4) - Process Design and Economics I
MET E 5780 (3) - Metals Manufacturing Processes
MET E 5055 (3) - Microsystems Design and Characterization
MET E 5210 (3) - Nuclear Materials: Processing, fabrication, use and disposal
MET E 5270 (3) - Powder Metallurgy
MET E 5290 (3) - Principles and Practice of Nanoscience and Technology
MET E 5600 (3) - Corrosion Fundamentals and Minimization
MET E 5610 (3) - Proton Exchange Membrane Fuel Cells
MET E 5660 (3) - Surfaces & Interfaces
MET E 5760 (4) – Process Design I
MET E 5780 (3) – Metals Manufacturing
MET E 5800 (3) - Special Topics in Metallurgical Engineering
MET E 5910 (3) - Selected Topic

Emphasis Options

Biomedical Devices and Sensors Emphasis

Metals are used in a wide variety of high-tech devices such as those that replace essential human physiology functions, such as heart valves, artificial hips, pace makers, etc. Understanding the durability and biocompatibility of these devices relies upon fundamental metallurgical engi¬neering subjects such as corrosion, surface chemistry, physical metallurgy, and strengths of metals. This emphasis gives students an advanced understanding of these applications and how to apply knowledge gained from their core curriculum to prepare students for careers in such high technology fields.

Required for BD&S Emphasis	Two of the Following Courses
MET E 5520 Biomedical Devices and Sensors MET E 5600 Corrosion MET E 5690 Process Engineering Statistics	MET E 5320 Materials and Environment MET E 5770 Electrometallurgy MSE 5040 Intro to Modern Biomaterials BIOEN 1020 Fund. of Bioengineering

Chemical Processing Emphasis

Extraction of metals from minerals or waste materials and subsequent purification requires a fundamental understanding of chemical processes and principles. Students who pursue this emphasis will strengthen their education in chemical processing to support pursuit of careers in metals recycling, purification, and extraction. Completing this emphasis should give the student the educational background to pursue career opportunities also open to chemical engineers and extractive metallurgists.

Required for Chemical Processing Emphasis	Three of the Following Courses
MET E 5600 Corrosion *OR* MET E 5770 Electrometallurgy	CHEM 2310 Organic Chemistry CHEM 3100 Inorganic Chemistry CH EN 3353 Fluid Mechanics MET E 5210 Nuclear Materials MET E 5330 Renewable Energy Conversion & Storage MET E 5520 Biomedical Devices and Sensors MET E 5800 Molten Salt Engineering
MET E 5765 Process Design and Economics II *OR* MET E 5690 Proc. Eng. Statistics	

Energy Conversion and Storage Emphasis

This emphasis provides in-depth instruction on the application of metallurgical engineering fundamentals to advanced energy production and storage systems-including renewable energy and nuclear energy. Students will learn about types of metals needed for these systems and requirements for developing advanced metal alloys to improve energy conversion and storage efficiency.

Required for EC&S Emphasis	Three of the Following Courses
MET E 5330 Renewable Energy Conversion & Storage	MET E 5320 Materials and Environment MET E 5600 Corrosion

MSE 5074 Photovolt. Materials & Solar Cells *OR* MET E 5770 Electrometallurgy	MET E 5690 Proc. Eng. Statistics MET E 5210 Nuclear Materials NUCL 3000 Nuclear Princ. In Eng. Sci. MSE 3210 Electronic Prop. Of Solids

Mineral/Particle Processing Emphasis

Mineral processing is the study of practical methods for concentrating methods from ores. It teaches methods such as communition/grinding, flotation, gravity separation, sorting, and de¬watering. This field serves as a bridge between mining engineering and metallurgical engineering. Students who study this emphasis will be particularly well qualified to pursue careers and the mining industry.

Required for Mineral Processing Emphasis	Three of the Following Courses
MET E 5680 Mineral Processing II MET E 5765 Process Design &Economics II	MET E 5320 Materials and Environment MET E 5690 Process Engineering Statistics MET E 5800 Image Analysis MG EN 3010 Intro to Mining GEO 3070 Mineralogy and Petrology for Eng. CH EN 3353 Fluid Mechanics

Nuclear Emphasis

Metals play a huge role in nuclear energy systems, making up the fuels, structural materials, and even coolants. Selection of optimal metals for nuclear energy systems requires understanding of physical properties, neutron interaction parameters, corrosion properties, cost, and fabricabil¬ity. This is an ideal emphasis for a metallurgical engineering student wishing to pursue a graduate degree in nuclear engineering or pursue a career related to nuclear energy, nuclear waste, or research into advanced nuclear systems and processes.

Required for Nuclear Emphasis	Two of the Following Courses
MET E 5210 Nuclear Materials MET E 5600 Corrosion	ENVST 3368 Energy Choices or the 21st Century MET E 5690 Process Engineering Statistics MET E 5770 Electrometallurgy MET E 5800 Molten Salt Engineering MET E 5800 Amorphous Materials NUCL 3200 Radiochemistry
MET E 5800 Nuclear Safeguards *OR* NUCL 3000 Nuclear Principles	

Physical Metallurgy Emphasis

Physical metallurgy is the study of the physical properties and processing methods for metals and alloys-including strength/hardness, microscopic structure, and phase properties. It studies the effect of both metal composition and processing methods on these properties. Alloy design is an important element of physical metallurgy that results in entirely new metals with targeted properties. Material characterization skills are key elements of the physical metallurgy emphasis. Students who study this

emphasis can pursue careers in a wide range of industries in which metal properties are key for success of the products.

Required for Emphasis	Three of the Following Courses
MET E 5270 Powder Metallurgy *OR* MET E 5300 Alloy and Material Design	MET E 5320 Materials and Environment MET E 5330 Renewable Energy Conversion & Storage MET E 5520 Biomedical Devices & Sensors MET E 5600 Corrosion MET E 5690 Process Engineering Statistics MET E 5800 Magnetic Materials MET E 5800 Amorphous Materials MET E 5800 Solid state Thermodynamics MET E 5800 Image Analysis ME EN 2650 Manufacturing for Engineering Systems MSE 3210 Electronic Properties of Solids
MET E 5460 Advanced Characterization *OR* MSE 3011 Materials Characterization	

Advising Information

Finishing MATH 1210 and 1220 during the first year is very important for students desiring to complete a B. S. degree in metallurgical engineering in four years. The University of Utah requires a recent (within two years) ACT, SAT, Accuplacer, or AP/IB Calculus exam score, or a recent concurrent enrollment (college-level course) grade to evaluate your math proficiency before deciding which math course you are allowed to take. Transfer students can satisfy prerequisites with transfer math classes. If you have not had a math course or placement test within two years, you will be required to take the Accuplacer exam.

If taking the Accuplacer exam, make sure you prepare well because your score determines your placement. Free practice exams are often available on the web through simple search engine queries. The Math department's math boot camps (MATH 10 and MATH 15) are accelerated review courses sometimes offered in one-week sessions. There are on-line prep tools such as ALEKS for a fee. The additional resources are particularly helpful for those who have not had a recent math course. For study resources and current information regarding math placement, please see the Math Department's website http://www.math.utah.edu/ or contact that METE Academic Advisor.

Students who will take a leave of absence or are nontraditional/part-time should consider their math course schedules carefully. The Math Department has indicated that if students take MATH 1210 or higher before taking a leave of absence, it is generally easy to receive instructor approval to continue with the next math course, provided the previous grade was good, and it has not been more than three or four years since taking the previous course.

Mathematics Placement

Placement in MATH 1210, Calculus I, would require *** AKLEKS Score. Please see the following website for more information related to the ALEKS Mathematics Assessment.

Chemical Placement

Placement in CHEM 1210 General Chemistry I requires one of the following: Accuplacer CLM of 75+, Math ACT of 25+, Math SAT of 600+, or AP Calc AB/BC of at least 2.

Course Schedules/Registration Information

The current class schedule can be accessed through the web (http://www.utah.edu/students/catalog.php), at the Olpin Union Service Desk (no charge with valid student ID), or by contacting the Scheduling Office at 201 S 1460 E Room 40, University of Utah, Salt Lake City UT 84112-9056.

Grades and Repeating Courses

Students must receive a grade of C– or better in each of the required major courses. Students are allowed to repeat required courses one time only. To repeat more than once and have the course count towards your requirements, you must submit a petition (see https://mse.utah.edu/materials-science-engineering/bs-program-of-study/ > Policies > Repeating Courses) to the department and meet with the undergraduate advisor.

Other University Requirements

Please see the Overview of Requirements and the University of Utah Bulletin (http://undergradbulletin.utah.edu/) for general requirements.

Transfer Credit

Transfer credit will be granted for a course(s) taken at another accredited institution so long as a grade of C or better was received and the course content was equivalent to the content of a corresponding required course in the Metallurgical Engineering curriculum. The grade will not transfer. Transfer credits must be approved by the department.

AP Credit

Students enrolled at the University of Utah who received scores of 3, 4, or 5 on a high school Advanced Placement (AP) exam can earn up to:

- Eight semester hours of credit for year courses
- Three semester hours of credit for half-year courses

Please refer to this website for more informationhttps://admissions.utah.edu/information-resources/prior-learning-credit/advanced-placement-credit/

CLEP Credit

College credit may also be obtained by passing College Level Entrance Placement (CLEP) tests to fulfill certain general education requirements. Please contact the Academic Advising office for additional information (450 SSB – (801) 581-8146).

Policy for Internship Emphasis Elective Credit

Students may earn 0.5 to 2 semester hours of emphasis elective credit for internship-related work experiences in industry or research labs, provided that the following criteria are met:

1. The student must be mentored by a company engineer.

2. The student must be primarily involved in testing/data analysis or process improvement/development activities where the student has the opportunity to practice and develop engineering skills.
3. The company must send in writing: a) verification that the student was involved in appropriate engineering activities; b) confirmation that the student was men¬tored by an engineer; and c) a general evaluation of the student's performance.
4. The student must register for Special Topics credit during the internship.
5. The student must write and submit a final report of 10 to 30 double-spaced pages, depending upon desired credit, that includes:
    a. Literature Survey of General Project Topic(s)
    b. Experimental Information
    c. Data Presentation and Analysis
    d. Project(s) Conclusions

Students need to include some data they have acquired as well as an analysis of their data as it relates to their project. However, students should omit proprietary details. Terms like process A or compound X should be used to protect sensitive company information. The report should not be submitted to the department until the company has had the opportunity to review it.

The course credit will be determined based upon the duration of the internship and the extent of the report. A final grade will be given based upon the final report and the company evaluation of the student's performance.

Related Professional Societies with Student Membership

Students are encouraged to participate in professional societies as both members and leaders. Professional societies provide valuable opportunities for leadership, service, social interaction, and industrial exposure. Societies with active student chapters in the metallurgical engineering area include Material Advantage and Institute of Nuclear Material Management.

Please visit the Department of Materials Science and Engineering in CME 304 for additional information about membership in these societies including current contact information.

Overview of Bachelor's Degree Requirements

To earn a bachelor's degree from the University of Utah you must complete the following requirements and meet minimum academic standards.

IMPORTANT NOTE: The minimum grades are noted for each requirement. However, if a course is also required for your major it MUST be taken for the letter grade and a higher grade may be required.

Academic Standards

Total Semester Credit Hours

A minimum of 120 semester credit hours is required for a bachelor's degree.

Upper Division Credit Hours

At least 40 of the required 120 semester hours must be at the 3000 level or above. Credits from 2-year schools will not count toward upper division hours.

Residency Hours

A minimum of 30 semester hours must be completed at the University of Utah.

20 of the last 30 semester hours must be completed at the University of Utah.

Telecourses, online courses and courses at satellite campuses count as hours in residence. Independent Study correspondence courses, petitioned courses and exam credits do not.

Minimum 2.0 Cumulative GPA

A 2.0 is the minimum GPA to stay in Good Standing at the University of Utah. Some departments may require higher GPAs.

Apply for Graduation

At least two semesters before graduation you must file an application to graduate. **Students with a catalog year prior to 2025 must complete a minimum of 122 credit hours. Students with a catalog year 2025 and beyond must complete a minimum of 120 credit hours.

General Education Requirements.

Students must fulfill the University of Utah's General Education and Bachelor's Degree requirements in addition to the METE degree requirements to graduate.

GE website https://ugs.utah.edu/general-education/requirements/index.php

General Education Requirements:

General Education (GE) Core Requirements:

- Lower Division Writing (3) (WR1) – 1 course
- Lower Division Writing (3) (WR2) – 1 course
- American Institutions (3) (AI) – 1 course
- Quantitative Literacy (3) (QL) – 1 course

General Education (GE) Breadth Requirements

- Fine Arts (3) (FF) – 1 course
- Humanities (3) (HF) – 1 course
- Life Science (3) (LS) – 1 course
- Physical Science (3) – 1 course
- Social/Behavioral Science (3) (BF) – 1 course

Bachelor's Degree Courses

- Communication & Writing (3) (CW) – 1 course
- Diversity (3) (DV) – 1 course
- International (3) (IR) – 1 course
- Quantitative Intensive (3) (QI) – 1 course

Requirements for a Major

When you enter the University of Utah you are listed as being in pre-major status. This is not the same as being declared into a major. To officially declare your major, you must meet with the departmental advisor.

1. Major coursework – see your departmental advisor or run a DARs for a list of requirements for your major
2. Other Departmental or College Requirements – some departments have additional requirements for graduation such as passing comprehensive exams. Check with your departmental advisor.

Second Bachelor's Degree

Students who have completed a bachelor's degree recognized by the University and now wish to earn a second bachelor's degree must fulfill the following requirements:

1. All requirements for the major
2. Residency Hours Requirement
3. American Institutions*
4. Lower Division Writing*
5. Upper Division Communication/Writing*
6. Diversity*
7. International Requirement*
8. Current Requirements for BS

*Not required if completed in the first bachelor's degree

Associate's Degrees

Associate of Arts (AA) and Associate of Science (AS) degrees automatically clear some General Education Requirements depending on which school awarded them.

Schools in the Utah System of Higher Education (USHE) and LDS Business College:

All General Education requirements are cleared with the possible exception of American Institutions (AI), which is checked separately by the Admissions Office.

Private Schools in Utah and all out of state schools:

Lower Division Writing and all Intellectual Explorations (IE) requirements are cleared automatically. The Admissions Office checks American Institutions (AI), Quantitative Reasoning (QA and QB).

NOTE: an Associate of Applied Science (AAS) degree will not automatically clear any General Education.

Course Numbering System

Noncredit Courses: 0001-0999
Lower Division Courses (Freshman and Sophomore) 1000-2999
Upper Division Courses (Junior and Senior) 3000-5999
Graduate Courses 6000-7990; NOTE: These graduate courses cannot be taken by undergraduate students without special permission from the department.