Missouri University of Science and Technology

Graduate Catalog

2012-2014

Missouri S&T publishes two catalogs - undergraduate and graduate. Both are official publications of Missouri S&T and may be requested from the Office of Admission or Office of the Registrar.

All statements in the publication are announcements of present policies only and are subject to change at any time without prior notice. They are not to be regarded as offers to contract.

Missouri S&T is an equal opportunity/affirmative action institution.

Statement of Affirmative Action

It is the policy of the Missouri University of Science and Technology to provide full and equal employment opportunities to all persons without regard to race, color, religion, sex, sexual orientation, national origin, age, disability, and veteran status; to prohibit discrimination in recruitment, employment or conditions of employment, including salary and benefits related thereto; to promote employment opportunity and to take affirmative action in this regard.

Title VI of the Civil Rights Act of 1964

"No person in the United States shall, on the ground of race, color, or national origin, be excluded from participation in, be denied the benefits of, or be subjected to discrimination under any program or activity receiving Federal financial assistance."

Title IX of the Education Amendments of 1972

"No person in the United States shall, on the basis of sex, be excluded from participation in, be denied the benefits of, or be subjected to discrimination under any education program or activity receiving Federal financial assistance."

Section 504 of the Rehabilitation Act of 1973

"No otherwise qualified handicapped individual in the United States...shall, solely by reason of the handicap, be excluded from the participation in, be denied the benefits of, or be subject to discrimination under any program or activity receiving Federal financial assistance."

Section 303 of the Age Discrimination Act of 1975

"No person in the United States shall, on the basis of age, be excluded from participation in, be denied the benefits of, or be subjected to discrimination under any program or activity receiving Federal financial assistance."

The Americans with Disabilities Act of 1990

Section 102 Discrimination

General Rule. – No covered entity shall discriminate against a qualified individual with a disability because of the disability of such individual in regard to job application procedures, the hiring, advancement, or discharge of employees, employee compensation, job training, and other terms, conditions, and privileges of employment. Missouri S&T conducts its programs and activities involving admission and treatment of students, employment, teaching, research, and public service in a non-discriminatory manner as prescribed by Federal law and regulation.

Inquiries concerning the above may be addressed to:

Chancellor, Missouri University of Science and Technology Rolla, Missouri 65409-9957

Director, Office for Civil Rights Department of Education Washington, D.C. 20201

INFORMATION ON THE WORLD WIDE WEB

For the most current information regarding course descriptions go to:http://registrar.mst.edu/ Students are also advised to consult the websites of individual department offices.



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Educational Goals of Missouri S&T

As Missouri's technological research university, Missouri University of Science and Technology's mission is to educate tomorrow's leaders. In a world growing increasingly dependent on science and technology, tomorrow's graduates must be prepared to be leaders in more than just their chosen professions. They must also be leaders in business, in government, in education, and in all aspects of society. Missouri S&T is dedicated to providing leadership opportunities for its students. The opportunity to receive an excellent technological education is only part of the educational experience received by students at Missouri S&T. Missouri S&T offers a full range of engineering and science degrees, coupled with business and liberal arts degrees and programs that are vital to the kind of comprehensive education that turns bright young men and women into leaders.

Missouri S&T is nationally recognized for its excellent undergraduate engineering programs, and is distinguished for producing cutting-edge research and key technologies vital to the economic success of Missouri and the nation. Missouri S&T has a distinguished faculty dedicated wholeheartedly to the teaching, research, and creative activities necessary for scholarly learning experiences and advancements to the frontiers of knowledge. Missouri S&T has excellent physical facilities, which support the best possible education in the liberal arts, engineering, science, applied science, and selected interrelated fields.

Missouri S&T's programs in science, engineering, and business, its technology transfer programs, its leadership opportunities, and its learning environment are all integral parts of the total educational package available to students who attend the Missouri University of Science and Technology.

Mission Statement

Missouri University of Science and Technology integrates education and research to create and convey knowledge to solve problems for our state and the technological world.

(Approved January 2008 Board of Curators meeting.)

Vision

Missouri University of Science and Technology will be recognized as one of the top five technological research universities in the nation.

On Jan. 1, 2008, UMR became Missouri University of Science and Technology, or Missouri S&T. Our new name will not only help us gain broader national recognition, but will also give us an identity that fits our mission - to be the state's technological research university.

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Joan Woodard, (retired) Sandia National Laboratories, Albuquerque, NM

Steve Wunning, Caterpillar, Inc., Peoria, IL

Missouri S&T Named Professorships

Baojun Bai, Lester Birbeck Endowed Chair Mariesa Crow, Fred W. Finley Distinguished Professorship of Electrical and Computer Engineering

Nuran Ercal, Richard K. Vitek/FCR Endowed Chair in Biochemistry

Ralph E. Flori, Jr., Gulf Oil Foundation Professorship Samuel Frimpong, Robert H. Quenon Missouri Endowed Chair in Mining Engineering

Stewart Gillies, Union Pacific Foundation/Rocky Mountain Energy Co. Professorship

Steven L. Grant, Roy A. Wilkens Missouri Telecommunications Distinguished Professorship

Shubhender Kapila, MO Soybean Res. Professorship Kamal Khayat, Vernon & Maralee Jones Endowed Professorship

Lampo Leong, Maxwell Weiner Professorship in Humanities **Ming Leu**, Keith & Pat Bailey Missouri Professorship in Mechanical Engineering & Aerospace Engineering

Frank Liou, *Michael and Joyce Bytner Product Innovation and Creativity Professorship*

Daniel B. Oerther, John & Susan Mathes Endowed Chair **Kent Peaslee**, F. Kenneth Iverson Chair of Steelmaking Technologies

Von L. Richards, Robert V. Wolf Assoc. Professor of Metals Casting in Metallurgical Engineering

David J. Rogers, Karl F. Hasselman Missouri Chair in Geological and Petroleum Engineering

Jagannathan Sarangapani, Rutledge-Emerson Professor in Electrical Engineering

Joseph D. Smith, Laufer Endowed Chair in Energy Jay Switzer, Castleman/FCR Missouri Professorship of Discovery in Chemistry

Donald Wunsch, Mary K. Finley Missouri Professorship in Computer Engineering

Reza Zoughi, Schlumberger Distinguished Professor in Electrical & Computer Engineering

Curators' Professors

Harlan U. Anderson of Ceramic Engineering (Emeritus)
 Bassem F. Armaly of Mechanical Engineering (Emeritus)
 S.N. Balakrishnan of Mechanical & Aerospace Engineering

Richard K. Brow of Ceramic Engineering

K. Chandrashekhara of Mechanical & Aerospace Engineering

Franklin Yih Cheng of Civil Engineering (Emeritus)

Alfred L. Crosbie of Mechanical Engineering

Delbert E. Day of Ceramic Engineering (Emeritus)

Lokesh Dharani of Mechanical Engineering

James Drewniak of Electrical Engineering

Walter Eversman of Mechanical & Aerospace Engineering

Greg Hilmas of Ceramic Engineering

Nicholas Leventis of Chemistry (Emeritus)

Don H. Madison of Physics

Rajiv S. Mishra of Materials Science and Engineering

Michael Schulz of Physics

James O. Stoffer of Chemistry (Emeritus)

David A. Summers of Mining Engineering (Emeritus)

Curators' Teaching Professorship

James J. Bogan of Arts, Languages and Philosophy (Emeritus)

James S. Drallmeier of Mechanical Engineering **Larry Gragg** of History & Political Science

Frances Dee Haemmerlie Montgomery of Psychology Leonard F. Koederitz of Geological & Petroleum

Roger A. LaBoube of Civil Engineering (Emeritus) Yinfa Ma of Chemistry

Kent D. Peaslee Materials Science & Engineering **O. Allan Pringle** of Physics

David C. Van Aken of Materials Science and Engineering

About the Campus

Engineering (Emeritus)

Founded in 1870 as one of the first technological schools west of the Mississippi, Missouri University of Science and Technology is one of the nation's top technological research universities. One of the four campuses in the University of Missouri System, the university was first known as the University of Missouri School of Mines and Metallurgy. It was later named the University of Missouri-Rolla in 196 and Missouri S&T in 2008.

The 284-acre campus is located in Rolla, MO, a town of nearly 20,000 in the heart of the Ozarks. The university offers bachelor of arts and bachelor of science degrees in 30 fields of study, including engineering, science, humanities, business and social sciences. Master of science degrees are offered in 27 disciplines, the doctor of philosophy in 20 and the doctor of engineering in eight.

The Missouri S&T campus is home to 50 research and academic support centers. Externally sponsored program expenditures have increased about 150 percent since FY2001, from \$17.23 million to \$38.08 million in FY2009. In FY2010, Missouri S&T received a record \$52.3 million in new grant and contract awards. Missouri S&T will enhance

its research activity and performance to be recognized as a top-five technological research university, distinguishing itself by interdisciplinary collaborations of national significance.

Missouri S&T enrolls more than 7,600 students from 50 states and 50-plus countries. More than 70 percent of students study in engineering, science or computer fields, but Missouri S&T also offers liberal arts, humanities, social science, and business degrees, as well as certification in select education fields. More than 700 different employers, many of the nation's top companies, recruited S&T graduates in 2010-11. S&T graduates also get great jobs at great salaries-nearly \$60,000 on average for those earning undergraduate degrees.

Campus Life

Missouri S&T offers a number of campus living options, including fraternity and sorority houses, traditional residence halls and the new Residential College. The university has more than 200 student organizations, including a dozen student design teams, a competitive NCAA Division II athletic program, student professional societies, a student radio station, and theatre and music programs. Each year, Missouri S&T students help to organize one of the largest St. Pat's celebrations in the nation.

University of Missouri Structure and History

The four University of Missouri campuses are located in Rolla, Columbia, Kansas City and St. Louis. Governing these campuses is the Board of Curators whose members are appointed by the Governor of Missouri and confirmed by the Missouri Senate. The president of the university directs and coordinates programs of all four campuses with assistance from staff in finance, business management, academic affairs, research, extension, development, public information, and other university services. The activities of each campus are under the supervision of a chancellor, who directs campus affairs within policies established by the UM Board of Curators and the president.

The University of Missouri has a long and proud history. It was established at Columbia in 1839, only 18 years after Missouri became a state. A land-grant university, UM is recognized as the first state university west of the Mississippi River. The university remained a single campus institution until 1870 when the University of Missouri School of Mines and Metallurgy (now Missouri S&T) was established at Rolla. Campuses at St. Louis and Kansas City were added in 1963.

On July 1, 1964, the UM Board of Curators took action to rename the University of Missouri School of Mines and Metallurgy to the University of Missouri-Rolla. The campus became Missouri University of Science and Technology on Jan. 1, 2008.

Accreditation

The University has been accredited by the Higher Learning Commission of the North Central Association of Colleges and Schools, http://www.ncahigherlearning commission.org, 30 North LaSalle Street, Suite 2400, Chicago, Illinois, 606025-2504. (312)263-0456 Further information on specialized accreditation by department is available in the Missouri S&T Fact Book or at: http://ira.mst.edu/accreditation.html.

Student Consumer Information

Various state and federal laws, specifically the Higher Education Opportunity Act, require Missouri University of Science and Technology to provide information and notice to students on a variety of topics. In addition, Missouri S&T occasionally develops statements or policies on important matters and distributes them to all students. For a listing of official notifications that are currently provided to students visit the web at:

http://registrar.mst.edu/student_consumer_info.html.

It is a student's responsibility to know and follow current requirements and procedures at the departmental and University levels, including those described in the University's Student Academic Regulations, Student Handbook, Undergraduate and Graduate Catalogs, Residential Housing Terms and Conditions and the Collected Rules and Regulations of the University of Missouri.

For More Information

If you have additional questions, contact the Director of Admissions, Missouri University of Science and Technology, Rolla, MO 65409-1060, or call (800) 522-0938 or visit http://admissions.mst.edu. You also may wish to contact one of the following offices for specific information:

- Career Opportunities Center (573) 341-4343
- Counseling & Disability Support Services (573) 341-4211
- Disability Support Services (573) 341-4222
- Distance & Continuing Education (573) 341-6576
- Extended Learning (573) 341-4132
- Intercollegiate Athletics (573) 341-4175
- International Affairs (573) 341-4208
- Registrar (573) 341-4181
- Residential Life & Student Support (573) 341-4218
- Student Diversity Programs (573) 341-4212
- Student Financial Aid (573) 341-4282
- Student Health Services (573) 341-4284
- University Police (573) 341-4300
- Vice Chancellor Student Affairs (573) 341-4292
- Women in Engineering & Science Programs (573) 341-4212

Calendar

Fall Semester 2012
International Student OrientationAugust 7Freshman Orientation BeginsAugust 12Transfer Student OrientationAugust 16Open Registration EndsAugust 19Classes Begin 8:00 a.mAugust 20Labor Day HolidaySeptember 3Mid-SemesterOctober 13Thanksgiving Vacation Begins 8:00 a.mNovember 18Thanksgiving Vacation Ends 8:00 a.mNovember 26Last Class DayDecember 7Final Exams Begin 8:00 a.mDecember 10Final Exams End 6:00 p.mDecember 14Semester Closes 6:00 p.mDecember 14December CommencementDecember 15
Spring Semester 2013International Student OrientationJanuary 14Open Registration EndsJanuary 20Martin Luther King, Jr. Recognition HolidayJanuary 21Classes Begin 8:00 a.mJanuary 22Spring Recess Begins 8:00 a.mMarch 14Mid-SemesterMarch 16Spring Recess Ends 8:00 a.mMarch 18Spring Break Begins 8:00 a.mMarch 24Spring Break Ends 8:00 a.mApril 1Last Class DayMay 10Final Exams Begins 8:00 a.mMay 13Final Exams End 6:00 p.mMay 17Semester Closes 6:00 p.mMay 17May Commencement - Graduate CeremonyMay 17May Commencement - Undergraduate CeremonyMay 18
Summer Session 2013Open Registration EndsJune 2Classes Begin 8:00 a.mJune 3Independence Day HolidayJuly 4Final Exams Begin 8:00 a.mJuly 25Final Exams End 12:30 p.mJuly 26Semester Closes 12:30 p.mJuly 26

Calendar

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International Student OrientationAugust 6Freshman Orientation BeginsAugust 11Transfer Student OrientationAugust 15Open Registration EndsAugust 18Classes Begin 8:00 a.mAugust 19Labor Day HolidaySeptember 2Mid-SemesterOctober 12Thanksgiving Vacation Begins 8:00 a.mNovember 24Thanksgiving Vacation Ends 8:00 a.mDecember 2Last Class DayDecember 6Final Exams Begin 8:00 a.mDecember 9Final Exams End 6:00 p.mDecember 13Semester Closes 6:00 p.mDecember 13December CommencementDecember 14
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Graduate Degree Programs

The Missouri University of Science and Technology offers master of engineering, master of science, master of arts (available as a cooperative degree program with UMSL), master of science for teachers, master of business administration, doctor of philosophy, and doctor of engineering degrees. Studies fall into the general areas of business, economics, engineering, English, science and technology.

Master of engineering degree

- · geotechnics
- manufacturing engineering
- mining engineering

Master of science degree

- · aerospace engineering
- biology, applied and environmental
- ceramic engineering
- · chemical engineering
- chemistry
- civil engineering
- computer engineering
- · computer science
- electrical engineering
- engineering management
- environmental engineering
- explosives engineering
- geological engineering
- · geology and geophysics
- information science & technology
- manufacturing engineering
- materials science and engineering
- mathematics (applied)
- mechanical engineering
- metallurgical engineering
- mining engineering
- nuclear engineering
- petroleum engineering
- physics
- systems engineering
- technical communication

Master of science for teachers degree

- chemistry
- mathematics
- physics

Master of arts degree

Available as a cooperative degree program with the corresponding departments of the University of Missouri-St. Louis. (A maximum of 12 graduate semester hours may be taken at Missouri S&T)

- economics
- English

Master of business administration

business administration

Doctor of philosophy degree

- aerospace engineering
- ceramic engineering
- chemical engineering
- chemistry
- civil engineering
- · computer engineering
- computer science
- electrical engineering
- engineering management
- geological engineering
- geology and geophysics
- · materials science and engineering
- mathematics
- mechanical engineering
- metallurgical engineering
- mining engineering
- · nuclear engineering
- · petroleum engineering
- physics
- · systems engineering

Doctor of engineering degree

- chemical engineering
- · civil engineering
- electrical engineering
- · geological engineering
- mechanical engineering
- mining engineering
- nuclear engineering
- petroleum engineering

Graduate minors

- explosives engineering
- technical communication

Graduate Certificates

Graduate Certificates

Actuarial Science

• Business Essentials

• Business Intelligence

• CAD/CAM and Rapid Product Realization

• Composite Materials and Structures

• Computational Intelligence

Contemporary Structural Engineering

Control Systems

• Electric Machine and Drives

Electrical Power Systems Engineering

Energy Conversion and Transport

Engineering ManagementEngineering Mechanics

• Enterprise Resource Planning

• Explosives Engineering

• Financial Engineering

• Financial Mathematics

Geoenvironmental Engineering

Geotechnical Earthquake Engineering

Geotechnics

• Human Computer Interaction

• Human Systems Integration

Information Assurance and Security

• Infrastructure Renewal

• Leadership in Engineering Organizations

Lean Six Sigma

• Management for Sustainable Business

Manufacturing Automation

• Manufacturing Systems

• Military Construction Management

Military Geological Engineering

· Mining Engineering

Multimedia and Information Systems

• Network Centric Systems

Project Engineering & Construction Mgt

Project Management

• Psychology of Leadership

• Psychometrics

Quality Engineering

Safety Engineering

• Software Design and Development

Systems Engineering

Systems and Software Arhcitecture

• Technical Communication

Wireless Networks and Mobile Systems

Discipline

Mathematics

Business Administration

Information Science & Technology

Manufacturing Engineering

Aerospace Engineering/Mechanical Engineering

Systems Engineering/Computer Engineering/Computer Science

Civil Engineering

Mechanical Engineering Electrical Engineering Electrical Engineering

Aerospace Engineering/Mechanical Engineering

Engineering Management Mechanical Engineering

Information Science & Technology

Mining Engineering

Engineering Management/Systems Engineering

Mathematics Civil Engineering Civil Engineering Geological Engineering

Information Science & Technology

Engineering Management/Information Science & Technology

Computer Engineering/Computer Science

Civil Engineering

Engineering Management/Psychology

Engineering Management Business Administration Mechanical Engineering Manufacturing Engineering

Civil Engineering/Engineering Management

Geological Engineering Mining Engineering Computer Science

Computer Engineering/Systems Engineering Civil Engineering/Engineering Management

Engineering Management/Information Science & Technology

Information Science and Technology/Psychology

Mathematics/Psychology Engineering Management

Chemical and Biochemical Engineering/Engineering Management

Computer Science Systems Engineering Computer Science Technical Communication

Computer Science

The Provost is responsible for the administration of all graduate work at Missouri S&T. In cases where your program can be demonstrably improved, the Provost can approve departures from the graduate faculty rules. Each department may have its own rules beyond the general ones listed and should be contacted if further information is desired at: http://grad.mst.edu/.