

# EXPLOSIVES ENGINEERING (EXP ENG)

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**EXP ENG 4099 Undergraduate Research** (IND 0.0-6.0)

Designed for the undergraduate student who wishes to engage in research. Not for graduate credit. Not more than six credit hours allowed for graduation credit. Subject and credit to be arranged with the instructor.

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**EXP ENG 5000 Special Problems** (IND 1.0-3.0)

Problems or readings on specific subjects or projects in the department. Consent of instructor required.

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**EXP ENG 5001 Special Topics** (LAB 0.0 and LEC 0.0)

This course is designed to give the department an opportunity to test a new course. Variable title.

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**EXP ENG 5112 Explosives Handling and Safety** (LEC 3.0)

Basic handling & safety for explosives, explosive devices and ordnance related to laboratory handling, testing, manufacturing & storage, for both civil and defense applications. Classroom instruction only. Prerequisite: Junior Standing or above.

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**EXP ENG 5512 Commercial Pyrotechnics Operations** (LAB 1.0 and LEC 2.0)

Provide participants with training preparing for Missouri Licensed Display Operator (Outdoor) License and advanced lead pyrotechnic operator training. Class work will be complemented by practical training in laboratory sessions, culminating in a full pyrotechnic show, from start to finish. Prerequisites: Both Chem 1310 and Chem 1319 or their equivalent; US Citizen or permanent resident, Successful background check, resident enrollment at Missouri S&T.

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**EXP ENG 5513 Stage Pyrotechnics and Special Effects** (LAB 2.0 and LEC 1.0)

Use of energetic materials in close proximity to audiences. Provide participants with training preparing for Missouri Pyrotechnics Display Operators License. Covers: close proximity indoor and outdoor pyrotechnics and special effects. Working with stage crews and talent, safety and permitting. Prerequisites: Both Chem 1310 and Chem 1319 or their equivalent; US Citizen or permanent resident, Successful background check, resident enrollment at Missouri S&T.

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**EXP ENG 5514 Display Fireworks Manufacturing** (LAB 2.0 and LEC 1.0)

Theory and practice of manufacturing display fireworks. Focusing on safety, chemical interaction, color development, basic theory, state and federal law. The lab will include hands on building of ball and canister shells and other pyrotechnic effects. Prerequisites: Chem 1310, Chem 1319, Chem 1100; one of Econ 1100, Econ 1200, Eng Mgt 1210; Successful background check.

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**EXP ENG 5555 Computer Fired Pyrotechnic Show Design and Firing System Operation** (LAB 2.0 and LEC 1.0)

Students will learn to use music editing, electronic firing system operation and Fire One pyrotechnic choreography and simulation software to design their own pyromusical show programs. Creation of a musical sound track, selecting the fireworks and choreographing to the musical score. Create, setup, diagnose and fire a pyrotechnic show. Prerequisites: Exp Eng 5512 or Exp Eng 5513 and successful background check.

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**EXP ENG 5612 Principles of Explosives Engineering** (LAB 1.0 and LEC 2.0)

Theory and application of explosives in the mining industry; explosives, initiating systems, characteristics of explosive reactions and rock breakage, fundamentals of blast design, drilling and blasting, regulatory and safety considerations. Prerequisites: Min Eng 1912; successful background check. (Co-listed with Min Eng 5612).

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**EXP ENG 5622 Blasting Design And Technology** (LAB 1.0 and LEC 2.0)

Advanced theory and application of explosives in excavation; detailed underground blast design; specialized blasting including blast casting, construction and pre-splitting. Introduction to blasting research. Examination of field applications. Prerequisites: Min Eng 5612. Student must be at least 21 years of age. Successful background check. (Co-listed with Min Eng 5622).

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**EXP ENG 5711 Explosives in Industry** (LEC 3.0)

Overview of how explosives are applied in various industrial settings. Focus is placed on the general application, identification, and necessity of explosives in industry. Topics include explosive use in surface and underground mining, road development, construction, utility placement, demolition, oil, gas, and underwater.

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**EXP ENG 5713 Demolition of Buildings and Structures** (LAB 1.0 and LEC 2.0)

Provide participants with basics and solid grounding in the equipment, techniques and processes required for the demolition and remediation of mine plant and processing equipment sites and non-mining structures such as buildings, factories, bridges, etc. Field trip required. Prerequisites: Preceded or accompanied by Civ Eng 2200 or Mech Eng 2340; US citizen or permanent resident; Successful background check.

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**EXP ENG 5721 Specialty Uses of Energetic Materials** (LEC 3.0)

Overview of special, less common uses of energetic materials and how they can be applied as a functional tool. Topics include the use of energetics in aerospace, explosive ordnance, oil field development, welding, pyrotechnics, theatrics, and cinematic special effects.

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**EXP ENG 5914 Explosives Manufacturing** (LEC 3.0)

History of industrial explosives from discovery to what is used today. Manufacturing processes for packaged and bulk explosives are explored along with specialty explosives such as detonating cord, cast boosters, detonators, shaped charges, and commercial fireworks. Field manufacturing of explosives by mixing or gassing is also covered. Prerequisites: Successful background check, consent of instructor.

**EXP ENG 5922 Tunneling & Underground Construction Techniques** (LAB 1.0 and LEC 2.0)

Mechanical and conventional excavation techniques in underground tunneling and construction. Topics include tunneling layouts design, equipment and performance modeling, ground control systems including support, drainage, and structural integrity. Construction specifications, advance rate and contractual and cost estimation. Prerequisite: Consent of instructor. (Co-listed with Min Eng 5922).

**EXP ENG 6000 Special Problems** (IND 1.0-3.0)

Problems or readings on specific subjects or projects in the department. Consent of instructor required.

**EXP ENG 6001 Special Topics** (LAB 0.0 and LEC 0.0)

This course is designed to give the department an opportunity to test a new course. Variable title.

**EXP ENG 6050 Continuous Registration** (IND 1.0)

Doctoral candidates who have completed all requirements for the degree except the dissertation and are away from the campus must continue to enroll for at least one hour of credit each registration period until the degree is completed. Failure to do so may invalidate the candidacy. Billing will be automatic as will registration upon payment.

**EXP ENG 6070 Graduate Cooperative Experience** (LAB 3.0)

Students on an approved internship will complete a project designed by the advisor and employer. The project selected must require that student apply critical thinking skills and discipline specific knowledge in the work setting. A major report and a formal presentation are required. Prerequisite: 12 hours Exp Eng coursework.

**EXP ENG 6080 Industry Project** (LAB 3.0)

Students who are currently employed may complete a project in their work setting designed by the advisor and employer. The project selected must require that student apply critical thinking skills and discipline specific knowledge. A major report and a formal presentation are required. Prerequisite: 12 hours Exp Eng coursework.

**EXP ENG 6099 Research** (IND 0.0-15)

Investigations of an advanced nature leading to the preparation of a thesis or dissertation. Prerequisites: Consent of instructor required.

**EXP ENG 6112 Explosives Regulations** (LEC 3.0)

Comprehensive coverage of the federal regulations governing the explosives industry, including those governing storage of explosives (ATF), transportation of explosives (DOT and TSA), the environment (EPA) and use of explosives (OSM, MSHA and OSHA). Prerequisite: Graduate standing.

**EXP ENG 6212 Theory Of High Explosives** (LEC 3.0)

Study of the application of chemical thermodynamics and the hydrodynamic theory to determine the properties of high explosives; application of detonation theory to steady-state detonations in real explosives; application of the above to the blasting action of explosives. Prerequisite: Graduate Standing; Math 1215, Chemistry 1310, Physics 1135, and either Exp Eng 5112 or Exp Eng 5612. (Co-listed with Min Eng 6632).

**EXP ENG 6292 Research Methods** (LEC 3.0)

Foundations, dimensions, and methods for designing and investigating research problems. Focus on fundamentals and applied research, research methods, literature review, experimental design and experimentation, dissertation composition, concepts of originality and intellectual property. Prerequisites: PhD students only. (Co-listed with Min Eng 6992).

**EXP ENG 6312 Scientific Instrumentation For Explosives Testing & Blasting** (LAB 2.0 and LEC 1.0)

Application of scientific principles, equipment description and operation for instrumentation of explosive events including blasting and high explosives. Topics: Set up and use of high-speed photography, motion detection and measurement, explosives properties testing, vibration measurement & analysis. Prerequisite: Exp Eng 5612 and Successful background check. Consent of instructor.

**EXP ENG 6412 Environmental Controls For Blasting** (LAB 1.0 and LEC 2.0)

Advanced blast mechanics; overbreak control including comprehensive coverage of perimeter and smoothwall specialist blasting techniques and geotechnical factors affecting blast vibration, limits analysis monitoring and control; air blast control including limits, monitoring and atmospheric and topographic effects. Prerequisites: Min Eng 5612, Successful background check. (Co-listed with Min Eng 6622).

**EXP ENG 6464 Advanced Blast Vibration Analysis and Prediction** (LEC 3.0)

Advanced Blast Vibration prediction methodologies. Includes typical methods including scaled distance, linear regression, signature hole analysis, and modern improved signature hole analysis. Structural response and damage criteria for blast vibrations including considerations for frequency spectra and amplitude. Prerequisite: Exp Eng 5612.

**EXP ENG 6767 Special Explosive Applications** (LAB 1.0 and LEC 2.0)

Advanced theory and special application of explosives other than for rock excavation. Students will be introduced to different industrial, military and government special uses such as avalanche control, explosive welding, forming, synthesis and hardening, aerospace, forest service, agriculture and oil industry applications. Prerequisites: Exp Eng 5612 or equivalent.

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