MIN ENG 5932/4932: (Advanced) Underground Mining Methods & Equipment

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Class Timings:  On campus: Monday, Wednesday, Friday 8:00 AM to 8:50 AM
Library 316

Distance Students: Material (Lectures, Assignments, Homework) will be uploaded every Thursday with due date duly mentioned for assignments/homework/quizzes

Catalogue Data: (5932) Advanced methods for designing, planning, developing and operating economic and efficient underground mining systems. Systems include mass mining methods, room and pillar, longwall, cut and fill with equipment, ventilation and drainage control interface. Research paper or design project required.

(4932) This course focuses on principles of planning, constructing, and operating economically viable underground mines. It discusses operational and economic details of various mining methods such as room-and-pillar, sublevel open stoping, VCR, shrinkage, sublevel caving, cut-and-fill, block caving, longwall. It also deals with the selection of equipment for underground mining operations and optimization of mine performance.

Course Objectives: The objectives of this course are to enable students

- to understand underground mining methods
- to comprehend operational, economic, environmental, technical, and technological aspects of underground mining methods
• to integrate scientific, engineering and designing concepts in the design of underground mines
• to appreciate socio-economic and environmental impacts of a underground mine
• to understand engineering principles relating to underground mining techniques, equipment and operations
• to grasp the intricacies of equipment selection and optimization

Prerequisites: Engineering standing, introductory courses of engineering design and working knowledge of CAD, statistics, spread sheets and word processing

Text Material:
2. *SME Mining Engineering Handbook* by Darling Peter (2011)
3. *Class Notes*

Reference Material:
2. *Planning the underground mine on the basis of mining method* by William Hustrulid

Course Material: Course material (including lectures, assignments, homework, quiz, project, and exams) will be uploaded on blackboard site. I have combined all sections to **1A (on Campus) section**. All the material for quizzes, exams, and lectures will be available at **1A section** under **Content Tab** (lecture material/solutions) and **Assignment Tab** (quizzes, homework, and exams). The material for **Distance class** (the recordings and other relevant information) will be uploaded inside the distance section of Blackboard i.e. **MIN ENG 5932-IDIS & MIN ENG 4932-IDIS**. Only distance students will have access to the recordings and live information. The assignments and homework will be due on subsequent Monday i.e.
approximately after 10 days unless mentioned otherwise. The due date for quiz, project, and exams will be posted with them.

Course Topics:

1. **Introduction**
   1.1. Underground Mine Terminology
   1.2. Introduction to Subsurface Mine Development
   1.3. Introduction to Underground Mining Methods
   1.4. Design Considerations and Underground Method
   1.5. Unsupported Methods: Room and Pillar, Sublevel Stoping, VCR, Shrinkage Stoping Methods, Cut and Fill, Undercut and Fill
   1.6. Caving Methods: Sublevel Caving, Panel Caving and Longwall Mining
   1.7. Caving Methods: Longwall Mining Method, concerns and issues, Shortwall Mining, Block Caving, Problems with caving method, Post mining activities
   1.8. Equipment Overview; and
   1.9. Equipment Production Estimating

2. **Mine Planning**
   2.1. General Mine Planning
   2.2. Planning for the various types of mining methods

3. **Mining Methods**
   3.1. Room and Pillar Stoping (R&P)
   3.2. Sublevel Open Stoping (SLOS)
   3.3. Vertical Crater Retreat (VCR)
   3.4. Shrinkage Stoping;
   3.5. Cut and Fill Stoping (C&F)
   3.6. Sublevel Caving Systems
   3.7. Block Caving
   3.8. Coal Mining Systems (includes hard rock Longwall methods)

4. **Mine Auxiliary Task and Equipment**
   4.1. Drills, Drilling and Drill Rounds
4.2. Blasting Applicable to Underground Operations

4.3. Auxiliary Operations & Equipment
   4.3.1. Ground control: pillar design and roof bolting
   4.3.2. Ground Support & New Austrian Tunneling Method (NATM)
   4.3.3. Shotcrete
   4.3.4. Grouting

4.4. Mechanical Methods
   4.4.1. Road headers, Continuous Miners & TBMs
   4.4.2. Shaft Sinking & Raise Boring Equipment
   4.4.3. Sampling, Dilution and Recovery
   4.4.4. Underground Backfill Systems

4.5. Environmental Issues Related to Mine Planning and Development

4.6. In Situ Solution Mining Methods

4.7. Mine Ventilation

4.8. Mine Drainage

4.9. Underground transportation systems, belt conveyors

5. Case Histories (Covered with Reading Assignments)

6. Health and Safety considerations

Term Paper (5932): Students will continually work on a term paper throughout the semester. The paper must be capable of at least conference publication. Students will choose a specific topic related to underground mining methods and equipment selection. Detailed requirements for this part of course will be shared the first week of class. The assignments and homework for 5932 will relatively be more challenging compared to 4932.

Grading:

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<td>Quizzes/Assignment 20%</td>
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**Communication:** Prefer mode of communication is WebEx, emails or blackboard forum. Skype conference may also be scheduled, if needed. You are encouraged to email me without hesitation 24/7.

**Honor Code and Academic Integrity:**

Honor code is strictly followed. All assignments, homework, and exams are individual tasks unless clearly specified as group assignments, homework, or exams. The Honor Code can be found at this link: [http://stuco.mst.edu/about/honor.shtml](http://stuco.mst.edu/about/honor.shtml). Please read and reflect upon the Honor code and its emphasis on HONESTY and RESPECT.

Page 30 of the Student Academic Regulations handbook describes the student standard of conduct relative to the University of Missouri System's Collected Rules and Regulations section 200.010, and offers descriptions of academic dishonesty including cheating, plagiarism or sabotage ([http://registrar.mst.edu/academicregs/index.html](http://registrar.mst.edu/academicregs/index.html)).

Other informational resources for students regarding ethics and integrity can be found online at [http://ugs.mst.edu/academicintegrity/studentresources-ai](http://ugs.mst.edu/academicintegrity/studentresources-ai).

**Video Communication Center (VCC):** [http://vcc.mst.edu](http://vcc.mst.edu)

The VCC web site [http://vcc.mst.edu](http://vcc.mst.edu) has information to help distance students. There is a lot of information available at the VCC website for students regarding course access, participating in live classes, lectures, and recording download. There is additional information on the VCC Students page at [http://vcc.mst.edu/stus/updatedstus/](http://vcc.mst.edu/stus/updatedstus/).
S&Tconnect:  [https://blackboard.mst.edu/](https://blackboard.mst.edu/) (S&T connect tab)

S&Tconnect provides an enhanced system that allows students to request appointments with their instructors and advisors via the S&Tconnect calendar, which synchronizes with the faculty or staff member’s Outlook Exchange calendar. S&Tconnect also facilitates better communication overall to help build student academic success and increase student retention. S&Tconnect Early Alert has replaced the Academic Alert system used by Missouri S&T. If more information is needed, please contact Rachel Morris at [rachelm@mst.edu](mailto:rachelm@mst.edu) or 341-7600.

**LEAD Learning Assistance: [http://lead.mst.edu](http://lead.mst.edu)**

The Learning Enhancement across Disciplines Program (LEAD) sponsors free learning assistance in a wide range of courses for students who wish to increase their understanding, improve their skills, and validate their mastery of concepts and content in order to achieve their full potential. LEAD assistance starts no later than the third week of classes. Check out the online schedule at [http://lead.mst.edu/assist](http://lead.mst.edu/assist), using zoom buttons to enlarge the view. Look to see what courses you are taking have collaborative LEAD learning centers (bottom half of schedule) and/or Individualized LEAD tutoring (top half of the schedule). For more information, contact the LEAD office at 341-7276 or email [lead@mst.edu](mailto:lead@mst.edu).

**The Burns & McDonnell Student Success Center:**

The Student Success Center is a centralized location designed for students to visit and feel comfortable about utilizing the campus resources available. The Student Success Center was developed as a campus wide initiative to foster a sense of responsibility and self-directedness to all S&T students by providing peer mentors, caring staff, and approachable faculty and administrators who are student centered and supportive of student success. Visit the B&MSSC at 198 Toomey Hall; 573-341-7596; [success@mst.edu](mailto:success@mst.edu); Facebook: [www.facebook.com/mstssc](http://www.facebook.com/mstssc); web: [http://www.studentsuccess.com](http://www.studentsuccess.com)

**Disability Support Services: [http://dss.mst.edu](http://dss.mst.edu)**

"If you have a documented disability and anticipate needing accommodations in this course, you are strongly encouraged to meet with me early in the semester. You will need to request that the Disability Services staff send a letter to me verifying your disability and specifying the accommodation you will need before I can arrange your accommodation."
Disability Support Services is located in 204 Norwood Hall. Their phone number is 341-4211 and their email is dss@mst.edu.

**Title IX:**

Missouri University of Science and Technology is committed to the safety and well-being of all members of its community. US Federal Law Title IX states that no member of the university community shall, on the basis of sex, be excluded from participation in, or be denied benefits of, or be subjected to discrimination under any education program or activity. Furthermore, in accordance with Title IX guidelines from the US Office of Civil Rights, Missouri S&T requires that all faculty and staff members report, to the Missouri S&T Title IX Coordinator, any notice of sexual harassment, abuse, and/or violence (including personal relational abuse, relational/domestic violence, and stalking) disclosed through communication including but not limited to direct conversation, email, social media, classroom papers and homework exercises.

Missouri S&T’s Title IX Coordinator is Vice Chancellor Shenethia Manuel. Contact her directly (manuels@mst.edu; (573) 341-4920; 113 Centennial Hall) to report Title IX violations. To learn more about Title IX resources and reporting options (confidential and non-confidential) available to Missouri S&T students, staff, and faculty, please visit http://titleix.mst.edu.