MinE 331: Mine Ventilation Engineering
* A Required Course for Mining Engineering B.S. Program *

Instructor: Yi Luo, Ph.D. and PE, Associate Professor
Lecture Hours: Tues, 4:00 - 6:50 PM, ESB 249
Laboratory Hours: Mon, 4:00 PM -
Office Hours: MRB 359A, Open door policy
Phone/E-mail: 293-7680 Ext 3306/yi.luo@mail.wvu.edu

Credit Hours: 3
Prerequisites: MinE 205 (Underground Mining Systems)


References:

Objectives: To familiarize the students with engineering principles, purposes, methods, and equipment applied to the underground ventilation and working environment.

Topics:
1. Basic gas thermodynamics
2. Components of Mine Ventilation Systems
3. Mine Ventilation Regulations, overview
4. Engineering Ethics
5. Dilution Requirements
6. Air Flow, Pressure Gradients
7. Head Losses, Air Power
8. Airway Resistances
9. Simple Ventilation Circuits
10. Controlled Splitting -- CPM Approach
11. Natural Ventilation
12. Fan Characteristics
13. Fan Applications
14. Complex Networks
15. Computer Aided Network Analysis
16. Auxiliary Ventilation
17. Economics of Airflow
18. Mine Ventilation Systems
19. Gas Control
20. Dust Control
21. Mine Fires and Explosions
22. Heat Sources and Standards in Mines

Laboratory Sessions:
1. Use of Vane Anemometer and Pitot Tube
2. Venturi Meters
3. Mine Pressure Survey and Shock Losses
4. Mine Characteristic Curve
5. Fan Characteristic Curve and Operating Points
6. Mine Ventilation Network Analysis
Report:
Each student will write a research report on the Westray Mine Disaster, focusing on areas where regulations were knowingly ignored or disobeyed, where ethical principles were violated, and the division of responsibility for these actions between owners, management, government, and labor.

Design Project: Each student will be given a map of a small room-and-pillar coal mine. He/she is required to utilize the knowledge learned through the course
- To lay out a mine ventilation system and the necessary control devices, emergency escape routes
- To determine ventilation parameters (e.g., environment, ventilation requirements, airway resistances, natural ventilation, etc.)
- To select proper mine fan
- To perform network analyses of the ventilation system using a personal computer program

Grading:

<table>
<thead>
<tr>
<th>Component</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Homework</td>
<td>30%</td>
</tr>
<tr>
<td>Report</td>
<td>5%</td>
</tr>
<tr>
<td>Project</td>
<td>15%</td>
</tr>
<tr>
<td>Laboratory</td>
<td>10%</td>
</tr>
<tr>
<td>Exams (2)</td>
<td>40%</td>
</tr>
<tr>
<td>Class attendance</td>
<td>±5%</td>
</tr>
</tbody>
</table>

Contribution of Course to Professional Component
Ventilation is a necessary operating component of any underground mining activity, and is essential not just for the operation but for the health and safety of the workforce involved. This course provides the skills needed to establish ventilation requirements and thereby design ventilation systems based on:
- regulatory requirements
- health concerns for workers
- levels of dusts and toxic or explosive gases present
- mining methods used
- splitting and delivery of different quantities of air to various workplaces, as required

This course especially ensures that students understand how to forecast such need and subsequently calculate power requirements for delivery, and design a system that will provide ventilation as it is needed. The capstone of this course is learning to use VnetPC, the most commonly used mine ventilation design software used in industry today.

Relationship of Course to Program Outcomes
This course contributes to the overall engineering knowledge required to design, construct, and operate an underground mine. It provides applications of mathematics and various mine design methods. It provides experience in considering multiple mining systems simultaneously, as would be needed in the field. It also provides an examination of engineering ethics as applied to mine operational decision-making, by examining a mine ventilation disaster in Canada, the Westray explosion.

Prepared by: Yi Luo                                      Date of Preparation: January 8, 2004