NATIONAL UNIVERSITY OF ENGINEERING

COLLEGE OF GEOLOGICAL, MINING AND METALLURGICAL ENGINEERING

MINING ENGINEERING PROGRAM

SM835 – MINE VENTILATION

I. GENERAL INFORMATION

CODE	**:**	SM835 Mine Ventilation
SEMESTER	**:**	8
CREDITS	**:**	3
HOURS PER WEEK	**:**	5 (Theory–Practice)
PREREQUISITES	**:**	SM714 Mining Support Services
CONDITION	**:**	Compulsory
DEPARTMENT	**:**	Mining Engineering

II. COURSE DESCRIPTION

The course prepares students in the design, planning and evaluation of mine ventilation systems to prevent and mitigate pollution generated by mining operations. The methods and techniques of fluid mechanics are applied to design high-performance and cost-effective ventilation systems. Health and safety norms and regulations are applied to fulfill environmental and legal requirements. At the end of the course, students complete the design of the ventilation systems for an underground mine project.

III. COURSE OUTCOMES

At the end of the course, students:

1. Organize the fieldwork plan in order to detect and evaluate the concentration of environment contaminants.
2. Explain the factors contributing to risks in ventilation and control methods.
3. Understand ventilation standards and determine the volume of air required for a specific work and final balance.
4. Analyze simulation reports of a ventilation system.

IV. LEARNING UNITS

1. FUNDAMENTALS AND ATMOSPHERIC AIR CHARACTERISTICS

Objectives of mine ventilation / Factors contributing to ventilation risks and control methods / Mine ventilation history / Air composition, respiration volume, human oxygen consume, atmospheric media, air density.

2. MINE GASES, DETENTION AND MONITORING

Mining safety and health regulations / Calculation of the required air flow to dilute contaminant gases / Acceptable limits of mine gases / Casuistic of accidents, monitoring and control.

3. POWDER AND HEAT IN MINES

Powder risk in mines / Occupational illness / Heat control and monitoring / Calculation of the required flow of air to control mine heat.

4. VENTILATION BASIC LAWS

Energy basic equation / Energy modified equation / Energy loses by friction / Power and speed of air / Useful equations of air flows / Atkinson equation.

5. **ELECTRIC CIRCUITS FOR VENTILATION**
   Kirchhoff laws / Series and parallel circuits / Complex circuits / Exercises.

6. **VENTILATION ANALYSIS**
   Analysis techniques / Air flows / Flow and pressure.

7. **NATURAL VENTILATION**
   Psychometric study techniques / Natural ventilation pressure / Study of flow of air and balance.

8. **MECHANICAL VENTILATION**
   Types of ventilators / Ventilators capacity / Monitoring of ventilators / Monitoring of ventilation.

9. **PRIMARY AND SECONDARY VENTILATION**
   Primary ventilation (suction system, injection system) / Types and characteristics. / Secondary ventilation / Characteristics / Auxiliary ventilation.

10. **COSTS OF VENTILATION**
    Capital expenditures / Operation expenditures / Optimal diameter of chimney.

11. **VENTILATION PROJECT**
    Typical cases / Research topics.

V. LABORATORY AND PRACTICAL EXPERIENCES:

1. Session 1: Practical work about atmospheric air characteristics, gas dilution and heat.
2. Technical visit 1: Ventilators factory (AIRTEC Co.)
3. Session 2: Practical work about ventilation networks.
4. Technical visit 2: Mining unit.
5. Session 3: Basic simulation of mine ventilation.
6. Session 4: Intermediate simulation of mine ventilation.

VI. METHODOLOGY

This course is organized in sessions of theory, practice and computing laboratory. In theory sessions, the concepts, ventilation laws and applications are explained by the teacher. In practical sessions, problems and practical cases are solved by students. In laboratory sessions, students use specialized simulation software to solve problems. There are also visits to ventilators factory and to mining sites.

VII. GRADING FORMULA

The Final Grade PF is calculated as follow:

PF = (EP + EF + PP) / 3

EP: Mid-term Exam EF: Final Exam
PP: Average of Practical Works

VIII. BIBLIOGRAPHY

1. HOWARD L. HARTMAN
   SME Mining Engineering Handbook, Society for Mining and Metallurgical Exploration, Inc., 2015.
2. MALCOM J. MC PHERSON.
   Subsurface Ventilation Engineering, 2010.