**DEPARTMENT OF MINING ENGINEERING**
**IIT (ISM) DHANBAD**

## LECTURE PLAN

**Subject: Advanced Mine Ventilation (MND 401)**

Session: 2025-26; Semester: Monsoon

**Subject Teacher:** Prof. D. P. Mishra **(L – T – P : 3 – 0 – 0)**

| Topics | Lecture Hours |
|---|---|
| **Unit – 1: Introduction and basics of mine thermodynamics:** Overview and importance of advanced mine ventilation, Basics of mine thermodynamics, Earth crust-infinite reservoir of heat and variation of strata temperature with depth, Computation of thermodynamic properties of mine air. Heat transfer in mine airways: Unsteady/Transient state, Quasi-steady state and steady state heat transfer, Heat transfer due to conduction, logarithmic mean area approach and related problems, Heat transfer due to convection and radiation in mines, and related problems, Heat transfer at wet surfaces, computation of rate of condensation and evaporation in mine airways and conceptual problems, Computation of heat transfer in tunnels depending upon age factor with numerical problems. | 13 |
| **Unit – 2 : Heat flow into bord and pillar, and longwall workings:** Heat and mass transfer in bord and pillar panels, Heat and mass transfer in longwall panels: Sources of heat in longwall panels, Computation of heat load and climatic conditions in mine workings, Mitigative measures for hot and humid workings, Longwall ventilation practices: Global experience, A case study of a deep, hot and humid mine of the country. | 8 |
| **Unit – 3 : Incompressible and compressible flow ventilation analysis:** Computation of volume flow using equivalent resistance method and numerical examples, Computation of volume flow using direct analysis: Application of Kirchoff's first and second laws to solve field problems, Derivation of Hardy Cross iterative method.<br><br>Thermodynamic principles applied to mine ventilation network analysis, Equations considering no change and change in moisture content, Application of these equations to complete mine circuit, Computation of resistance of mine roadways with change in moisture content using Atkinson's equation and Darcy-Weisbach equation, related numerical problems. | 10 |
| **Unit – 4 : Mine air conditioning:** Improvement of workplace environment in underground, Basic vapour-compression refrigeration system, Pressure-enthalpy diagram and super-imposition of pressure-enthalpy diagram on vapour compression cycle, A case study of designing mine air-conditioning system. | 7 |
| **Unit – 5 : Monitoring and control of underground mine environment:** Advanced underground mine environmental monitoring systems, automation, and control. | 4 |

**List of Text/Reference Books**

- Subsurface Ventilation and Environmental Engineering - by M.J. McPherson
- Mine Ventilation and Air Conditioning - by H.L. Hartman, Jan Mutmansky and Y.J. Wang
- Mine Environmental Engineering, Vol. 1 & Vol. 2 - by Mritunjoy Sengupta
- Environmental Engineering in Mines - by V.S. Vutukuri and R.D. Lama
- Mine Environment and Ventilation - by G.B. Mishra
- Mine Ventilation - by S.P. Banerjee
- 1st-12th International Mine Ventilation Congress (IMVC) Volumes

24/07/25

**(D. P. Mishra)**
Professor