Course Code	Course Title	Credit Hours
ENE-815	Aerosol Science and Technology	3 (3+0)

Course Description

This course will allow students to explore the properties, transformation, fate, and measurement (conventional and advanced methods) of aerosol/particulates in the atmosphere. This course is suitable for graduate students, or advanced undergraduates who have backgrounds in environmental and chemical engineering, chemistry, and physics with the understanding of calculus. This course is also appropriate for professionals and researchers who measure, evaluate, or control airborne particles within the fields of air pollution control, and environmental science and technology.

Course Outline

Introduction to Aerosols: Definitions, Particle Size, Shape, and Density, Aerosol Concentration

Properties of Particles and Gases: Kinetic Theory of Gases, Molecular Velocity, Mean Free Path, Reynolds Number, Measurement of Velocity, Flow Rate, and Pressure.

Uniform, Straight, and Curvilinear Motion of Particles: Newton's Resistance Law, Stokes's Law, Settling Velocity and Mechanical Mobility, Straight-Line Particle Acceleration, Stopping Distance, Curvilinear Motion and Stokes Number, Inertial Impaction.

Adhesion and Diffusion of Aerosols: Adhesive Forces, Detachment of Particles, Diffusion Coefficient, Particle Mean Free Path, Brownian Displacement.

Thermal and Radiometric Forces: Thermophoresis, Thermal Precipitators, Radiometric and Concentration Gradient Forces.

Coagulation, Condensation, and Evaporation of Aerosols: Simple Monodisperse, Polydisperse and Kinematic Coagulation, Kelvin Effect, Homogeneous Nucleation, Growth by Condensation, Evaporation.

Respiratory deposition: The Respiratory System, Deposition Models, Inhalability of Particles.

Electrical and optical properties: Electric Fields, Electrical Mobility, Charging Mechanisms, Corona Discharge, Extinction, Scattering, Visibility.

Filtration, Sampling, and Measurement of Aerosols: Macroscopic Properties of Filters, Single-Fiber Efficiency, Deposition Mechanisms, Filter Efficiency, Isokinetic Sampling, Sampling from Still Air, Measurement of Mass Concentration.

Advanced Aerosol Measurement Techniques: Direct-Reading Instruments, Measurement of Number Concentration.

Recommended Books

1. Aerosol Technology: Properties, Behavior, and Measurement of Airborne Particles (2022), 3rd Edition William Hinds and Yifang Zhu, ISBN 978-1-119-49404-1
2. Aerosol Science: Technology and Applications (2014), Ian Colbeck and Mihalis Lazaridis, ISBN 978-1-119-97792-6