

CE 544 Environmental Air Pollution

Credit and Contact hours	3 / 3 (Lectures), 0 (Tutorials), 0 (Laboratory)												
Required, or Elective	Required												
Course Description	Air pollutants causes, sources, and effect; air emission standards; design of equipment and system for removal of particulate and gaseous pollutants emitted from stationary source; air pollution and meteorology, emission dispersion equations and modeling.												
Prerequisites or Co-requisites	None												
Course Learning Outcomes	<p>Students completing this course successfully will be able to:</p> <table> <thead> <tr> <th>Course Learning Outcomes (CLOs)</th><th>Related Student Outcomes (SO)</th></tr> </thead> <tbody> <tr> <td>CLO1. Identify and recognize regulatory requirements for air emission from different sources. K1</td><td>SO1</td></tr> <tr> <td>CLO2. Use engineering modeling techniques to predict air emission depression. S1</td><td>SO2</td></tr> <tr> <td>CLO3. Identify and define the current issues related to air pollution. S2</td><td>SO3</td></tr> <tr> <td>CLO4. Design air pollution control devices and systems subjected to a regulatory framework and evaluate its effectiveness. S4</td><td>SO5</td></tr> <tr> <td>CLO5. Develop a plan for implementing a treatment option that is feasible and meets regulatory requirements. V2</td><td>SO7</td></tr> </tbody> </table>	Course Learning Outcomes (CLOs)	Related Student Outcomes (SO)	CLO1. Identify and recognize regulatory requirements for air emission from different sources. K1	SO1	CLO2. Use engineering modeling techniques to predict air emission depression. S1	SO2	CLO3. Identify and define the current issues related to air pollution. S2	SO3	CLO4. Design air pollution control devices and systems subjected to a regulatory framework and evaluate its effectiveness. S4	SO5	CLO5. Develop a plan for implementing a treatment option that is feasible and meets regulatory requirements. V2	SO7
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Student Outcomes related to this Course	<p>SO 1 Recognize advanced engineering knowledge, concepts, and techniques to identify, interpret, and analyze complex and real-life engineering problems.</p> <p>SO 2 Provide solutions for complex and real-life engineering problems through critical thinking and the use of modern engineering tools, and identify their impact on social, global, cultural, environmental, safety, and economic factors.</p> <p>SO 3 Investigate scientific research problems independently or through teamwork using critical thinking, appropriate techniques, advanced tools, and management principles.</p> <p>SO 5 Design novel advanced Civil Engineering systems and evaluate their performance, sustainability, and effectiveness for engineering practice and their impact in global, economic, environmental, and societal contexts</p> <p>SO 7 Effectively manage, individually or in groups, specialized tasks and activities in coursework, projects, assignments, and research work with a high level of autonomy and responsibility.</p>												

Topics Covered	List of Topics	Related CLOs
	1. Introduction to Air Pollution <ul style="list-style-type: none"> Definition and Classification of Air Pollutants Sources of Air Pollution (Natural & Anthropogenic) Historical Air Pollution Episodes and Their Impact Air Quality and Human Health Environmental and Economic Consequences of Air Pollution 	CLO 3
	2. Air Pollution Regulations and Standards <ul style="list-style-type: none"> International and Regional Air Quality Standards (WHO, EPA, EU, Saudi Regulations) National and Local Air Emission Regulations in Saudi Arabia Compliance and Enforcement of Air Quality Standards Environmental Impact Assessment (EIA) for Air Pollution 	CLO 1,5
	3. Air Pollutant Emission and Characteristics <ul style="list-style-type: none"> Major Air Pollutants (Particulate Matter, NO_x, SO_x, CO, VOCs, Heavy Metals) Formation Mechanisms of Primary and Secondary Pollutants Source Characterization (Point, Area, and Mobile Sources) Indoor Air Pollution and Its Effects 	CLO 1, 5
	4. Meteorology and Air Pollution <ul style="list-style-type: none"> Atmospheric Stability and Mixing Height Wind Flow and Pollutant Transport Temperature Inversions and Their Effect on Air Pollution Meteorological Data Interpretation for Air Pollution Studies 	CLO 2
	5. Air Pollution Dispersion and Modeling <ul style="list-style-type: none"> Gaussian Plume Model and Its Application Regulatory Models for Air Pollution Prediction (AERMOD, CALPUFF) Source Inventory and Emission Estimation Case Studies on Air Dispersion Modeling 	CLO 2,3
	6. Particulate and Gaseous Pollutant Control Technologies <ul style="list-style-type: none"> Particulate Matter Control: Cyclones, Electrostatic Precipitators, Fabric Filters, Wet Scrubbers Gaseous Pollutant Control: Adsorption, Absorption, Catalytic and Thermal Oxidation Control of NO_x, SO_x, and VOCs in Industrial Facilities Best Available Control Technologies (BACT) and Cost Considerations 	CLO 4, 5
	7. Air Pollution Management and Sustainable Strategies <ul style="list-style-type: none"> Air Pollution Monitoring and Measurement Techniques Industrial Emission Reduction Strategies Carbon Capture and Storage (CCS) Technologies Green Technologies and Sustainable Urban Planning for Air Quality Improvement 	CLO 3, 5
	8. Case Studies and Emerging Issues in Air Pollution <ul style="list-style-type: none"> Air Pollution in Mega Cities (Riyadh, Beijing, Delhi, Los Angeles) Climate Change and Air Quality Interactions Technological Advances in Air Pollution Control Future Directions and Research Needs in Air Pollution Engineering 	CLO 3, 5
Textbook(s) and Other	<ul style="list-style-type: none"> C. David Cooper and F. C. Alley (2011) Air Pollution Control: A Design Approach, 4th edition: Waveland Press. Daniel A. Vallero (2014) Fundamentals of Air Pollution, 5th edition: Elsevier. 	

Required Material	
Grading System	<div>Assignments20%</div> <div>Mid-term exam20%</div> <div>Air pollution control design project20%</div> <div>Final Exam40%</div>
Instructors	Dr. Mohab Amin / Dr. Abdulrhman Al-Ali / Prof. Anwar Khursheed Ahmad
Date of Review	November, 2024