



UNIVERSITI TEKNOLOGI MARA

EVT524: EMISSION CONTROL TECHNOLOGY

Course Name (English)	EMISSION CONTROL TECHNOLOGY APPROVED
Course Code	EVT524
MQF Credit	2
Course Description	This is a graduate course oriented to provide graduate students with the knowledge and skills for understanding and implementing appropriate air pollution control strategies. The course covers the main methodology on control of gases and particulate from the combustion, industrial processes and mobile sources. The control techniques and current technologies to reduce the pollutants emission in the atmosphere are emphasized.
Transferable Skills	1. Able to identify types and sources of air pollutants. 2. Able to point out legal and regulatory requirement for control of air pollutants emission. 3. Able to illustrate air particulate and gases pollutants emission control measures.
Teaching Methodologies	Lectures, Blended Learning, Lab Work, Discussion, Presentation
CLO	CLO1 Explain the general principles of air pollution control technologies for air pollutants (particulate and gases) CLO2 Compare the air control technologies and techniques efficiency with legislative requirement. CLO3 Report verbally and in writing the principles of air pollution control technologies for particulates and gases to the environment.
Pre-Requisite Courses	No course recommendations
Topics	
1. Overview of Air Pollution 1.1) 1.1 Brief description of major types of anthropogenic air pollutants, their sources and effects on urban population, environment and ecosystem worldwide 1.2) 1.2 Brief overview of legislations and standards governing air pollution 1.3) 1.3 General current status of air pollution at local, national, regional and global scene. 1.4) 1.4 Introduction to general principles of air pollution control strategies	
2. Introduction to Industrial Processes and Emissions 2.1) 2.1 Chemical Processing plants and types of emissions 2.2) 2.2 Agricultural Industries and activities and types of emissions 2.3) 2.3 Incineration and combustion technology and emissions 2.4) 2.4 Problems of Mobile emission; alternative fuels	
3. Particulate Pollutants 3.1) 3.1 Nature of particulate pollutants 3.2) 3.1.1 Classifications, characteristics, size distribution, chemical compositions 3.3) 3.1.2 Formation mechanism 3.4) 3.1.3 Sources and sinks 3.5) 3.1.4 Behavior in the atmosphere, aerodynamic diameter, terminal settling velocity and its calculation 3.6) 3.2 Control of primary particulates: principle of operations, comparative efficiencies, advantages, disadvantages 3.7) 3.2.1 Wall collection devices: gravity settlers, centrifugal separators: cyclones, electrostatic precipitators 3.8) 3.2.2 Baghouse filters 3.9) 3.2.3 Particulate scrubbers: venturi scrubbers	

4. Control of Nitrogen (NO_x)

- 4.1) 4.1 Control technologies for gaseous air pollution: substitution, condensation, adsorption, incineration, biofiltration, alternative fuels
- 4.2) 4.2 An overview of nitrogen oxides problems: comparison with SO_x
- 4.3) 4.3 Combustion classification of NO_x: prompt NO_x, thermal NO_x, fuel NO_x
- 4.4) 4.4 Control of NO_x emissions
- 4.5) 4.4.1 Combustion modifications: staged combustion (reburning), Flue Gas Recirculation (FGR)
- 4.6) 4.4.2 Postflame treatment: Selective Catalytic Reduction (SCR), Non-Selective Catalytic Reduction (NSCR) for NO_x

5. Control of Sulphur Oxides (SO_x)

- 5.1) 5.1 An overview of sulphur problem, reduced sulphur, concentrated SO_x gas stream, dilute SO_x gas stream
- 5.2) 5.2 Removal of sulphur from petroleum and natural gas streams
- 5.3) 5.3 Removal of SO₂ from rich waste gas
- 5.4) 5.4 Removal of SO₂ from lean waste gas (flue gas desulphurization): wet and dry scrubbers, limestone/lime scrubbers, problems and development
- 5.5) 5.5 Alternative processes: desulphurization of fuels, combustion process modification

6. Control of Incompletely Oxidized Organic Compounds and Carbon

- 6.1) 6.1 Characteristics and mechanism of formation in combustion process
- 6.2) 6.2 The mobile source problem: the motor vehicle emissions
- 6.3) 6.3 Control techniques: combustion modifications and optimization, catalytic converter, alternative fuels

7. Characteristics and control of VOCs & Hydrocarbons

- 7.1) 7.1 Characteristics and types of emissions
- 7.2) 7.2 Control techniques: adsorption, absorption and incineration

Assessment Breakdown		%	
Continuous Assessment		100.00%	

Details of Continuous Assessment	Assessment Type	Assessment Description	% of Total Mark	CLO
	Assignment	Special topic on air pollution control (Group project)	20%	CLO2
	Final Test	Final Test questions will be assessed the student knowledge on the principle of air pollution control devices and collection efficiency for stationary and mobile sources on the topics discussed for that particular semester.	40%	CLO1
	Lab Exercise	Cumulative of 5 laboratory reports on efficiency of various air pollution control devices.	20%	CLO3
	Presentation	Presentation of assignment based on the group project	20%	CLO3

Reading List	Recommended Text	<ul style="list-style-type: none"> Cooper, C. D., Alley F.C. 2011, <i>Air Pollution Control</i>, 4th. Edition Ed., Waveland Press Inc [ISBN: 1-57766-678-X]
	Reference Book Resources	<ul style="list-style-type: none"> De Nevers, N. 2000, <i>Air Pollution Control Engineering</i>, Ed., , McGraw Hill, New York [ISBN:] Flagan, R. C., and Seinfeld, J.H., 1988, <i>Fundamentals of Air Pollution Engineering</i>, Ed., , Prentice Hall: Englewood Cliffs [ISBN:] Finlayson-Pitts, B. J., and Pitts, J. N., Jr 1986, <i>Atmospheric Chemistry: Fundamentals and Exper</i>, Ed., , Wiley: New York [ISBN:] Wark, K., Warner, C. F., and Davis, W.T 1998, <i>Air Pollution: Its Origin and Control</i>, 3 Ed., , Addison-Wesley, Menlo Park [ISBN:] Rao C. S. 1997, <i>Environmental Pollution Control Engineering</i>, New Age International Ltd, New Delhi.
Article/Paper List	This Course does not have any article/paper resources	
Other References	This Course does not have any other resources	