

BITS, PILANI, DUBAI CAMPUS
DUBAI INTERNATIONAL ACADEMIC CITY, DUBAI
Second SEMESTER 2011-2012
Environmental Pollution Control (CHE C411/ ET C362)
Comprehensive Examination (Closed Book)

DATE: 12-01-2012

DURATION: 3 hours

MAXIMUM MARKS: 40

Note: Attempt ALL questions. Attempt Part A and Part B in separate answer sheets.

Part A

This part consists of 8 questions and carries 20 marks.

1. What do you understand by natural and anthropogenic sources of environmental pollution? Give two examples of each with respect to air pollution. [2]
2. Draw the temperature – altitude profile when inversion exists in the atmosphere. What are the three different types of inversion? [3]
3. With temperature – altitude profile and plume diagram explain the six types of plume behavior under different meteorological conditions. [6]
4. With example explain the difference between primary pollutants and secondary pollutants. [1]
5. Explain the relationship between ambient & adiabatic lapse rate and atmospheric stability. [1]
6. Explain with relevant chemical reactions how dissolved oxygen is measured in a wastewater sample? [2]
7. What are the different phases of bacterial growth? Write the Monod equation describing the specific growth rate of microorganisms. [2]
8. What are the different methods of air supply to the aeration tank of the activated sludge process? Explain with the help of diagrams. [3]

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Part B

This part consists of 5 questions and carries 20 marks.

1. A multi-tray settling chamber having 10 trays handles $12 \text{ m}^3/\text{s}$ of air at 20°C . The trays are spaced 0.25 m apart and the chamber is 1 m wide and 8 m long. Given: air viscosity at $20^\circ\text{C} = 1.6 \times 10^{-5} \text{ kg/m-s}$, air density = 1.25 kg/m^3 . [4]
- a) Determine the minimum particle size of density 2800 kg/m^3 that can be collected with 100% efficiency, assuming laminar flow condition within the chamber.
- b) What will be the efficiency of the settling chamber if 30 micron particles are to be removed?
- c) Verify if in the above calculation, the laminar flow assumption is justified or not.

2. A grit particle of 0.2 mm diameter and 2200 kg/m^3 density is to be captured in a horizontal grit chamber of 25 m length and 1.8 m width. The wastewater approach velocity carrying the grit particle is 0.4 m/s and the flow rate is 200 liters/s . Determine whether the particle will be settled in the grit chamber or not. Given: density of wastewater = 1000 kg/m^3 , and its viscosity = 0.0016 kg/m-s . [4]

3. The BOD results given below are observed on a sample of waste water:

t, days	0	1	2	4	6	8	12	16
BOD, mg/L	0	5.25	10.64	16.72	21.37	28.80	42.10	52.35

Calculate the reaction-rate constant k_1' and ultimate BOD, L_u . Use the Thomas method and linear regression. [6]

4. A completely mixed activated sludge process is to be designed to treat $18000 \text{ m}^3/\text{d}$ of industrial waste containing 1500 mg/l of BOD_5 . Environmental norms require that the effluent be treated to a level of 55 mg/l . The unit operates at a MLVSS of 6000 mg/l . The underflow concentration is 10000 mg/l . other data are: $Y = 0.5$, $k = 6/\text{day}$, $K_d = 0.06/\text{day}$, $K_s = 110 \text{ mg/L}$. calculate: [4]

- a) The treatment efficiency,
b) Mean cell residence time,
c) Hydraulic retention time,
d) Volume of the aeration tank.

5. Traffic noise data are shown in the table below:

Time(s)	10	20	30	40	50	60	70	80	90	100
dB	71	75	70	78	80	84	76	74	75	74

Compute L_{eq}

[2]

*** END OF PAPER ***

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Test – 2 (Open Book)

DATE: 22.12.2011

DURATION: 50 MINUTES

MAXIMUM MARKS: 20

Note: Attempt ALL questions. Do not alter any data.

1. Explain the different process modifications in the method of air supply to the aeration tank of the activated sludge process? [3]
2. What are the different advanced methods for treatment of waste water (only mention the names)? Briefly explain the process of electrocoagulation with bipolar electrodes. [2+3]
3. What is composting? Mention the different methods of composting of solid wastes. Compare and contrast Indore and Berkeley methods of composting. [1+1+3]
4. The noise levels at a particular location are 62dB, 66dB and 82dB measured during an hour of the day. Find out the average noise levels at the location. [3]
5. It is required to find out the day-night equivalent noise levels at a location. The three-hourly day average values in dB are 46, 53, 58, 51, 64 and three-hourly night average values in dB are 37, 41, and 49. Compute Ldn. [4]

*** END OF PAPER ***

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DUBAI INTERNATIONAL ACADEMIC CITY, DUBAI
First SEMESTER 2011-2012
Environmental Pollution Control (CHE C411/ET C362)
Test – 1 (Closed Book)

DATE: 03.11.2011

DURATION: 50 MINUTES

MAXIMUM MARKS: 20

Note: Attempt ALL questions.

1. A multi-tray settling chamber having 10 trays handles $12 \text{ m}^3/\text{s}$ of air at 35°C . The trays are spaced 0.30 m apart and the chamber is 2 m wide and 5 m long. Given: air viscosity at $35^\circ\text{C} = 1.6 \times 10^{-5} \text{ kg/m-s}$, air density = 1.2 kg/m^3 . [5]
 - a) Determine the minimum particle size of density 2400 kg/m^3 that can be collected with 100% efficiency, assuming laminar flow condition within the chamber.
 - b) What will be the efficiency of the settling chamber if 40 micron particles are to be removed?
 - c) Verify if in the above calculation, the laminar flow assumption is justified or not.
2. A grit particle of 0.15 mm diameter and 2100 kg/m^3 density is to be captured in a horizontal grit chamber of 20 m length and 2 m width. The wastewater approach velocity carrying the grit particle is 0.34 m/s and the flow rate is $0.18 \text{ m}^3/\text{s}$. Determine whether the particle will be settled in the grit chamber or not. Given: density of wastewater = 1000 kg/m^3 , and its viscosity = 0.0012 kg/m-s . [7]
3. The BOD results given below are observed on a sample of waste water:

t, days	0	1	2	3	4	6	8	10
BOD, mg/L	0	5.5	10.4	16.2	21.7	28.8	41.1	52.3

Calculate the reaction-rate constant k_1 and ultimate BOD, L_u . Use the Thomas method and linear regression. [8]

*** END OF PAPER ***

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First SEMESTER 2011-2012
Environmental Pollution Control
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Quiz

DATE: 03.10.2011

DURATION: 20 MINUTES

MAXIMUM MARKS: 10

Note: Attempt ALL questions. This quiz consists of 20 questions. All questions carry equal marks.

Student's Name:

I.D.

1. Which among the following is the single largest pollutant in the urban atmosphere?
a) SO₂ b) NO₂ c) CO d) NH₃

2. Which gas is reddish brown in color, has a strong odor, is a major pollutant, and is a component of photochemical smog?
a) Ozone b) SO₂ c) NO₂ d) CO₂

3. What is the major source of pollutant Cadmium in the urban atmosphere?
a) Automobile exhaust
b) Cigarette smoke
c) Wild fires
d) Fertilizers

4. Biosphere extends to about km from the bottom of the ocean to the highest point in the atmosphere
a) 1 km b) 2 km c) 20 km d) 200 km

5. Decomposers are organisms like
a) Hawks and vultures
b) Bacteria and fungi
c) Human beings and other mammals
d) Insects and birds

6. Precipitation and advection are processes which are parts of:
a) carbon cycle
b) nitrogen cycle
c) hydrologic cycle
d) phosphorus cycle

7. Which of the following is the biggest reservoir for carbon on earth?
a) atmosphere b) soil c) ocean d) living beings
8. Necrosis is
a) A disease of the lungs
b) A disease of the leaves of a plant
c) Discoloring of limestone building because of pollution
d) A disease of the kidneys
9. Which of the following metals is considered a neurotoxin?
a) Copper b) lead c) Iron d) Nickel
10. Which of the following is NOT a type of atmospheric inversion?
a) advective
b) conditional
c) radiational
d) subsidence
11. Which of the following is a secondary pollutant?
a) SO₂ b) H₂S c) NO d) SO₃
12. Which Sector is responsible for highest global SO₂ emissions?
a) Power Generation b) Non-ferrous metals c) Industry d) Road
13. Which of the following conditions does NOT contribute to the formation of photochemical smog?
a) Air stagnation
b) Cloudy climate
c) High concentrations of hydrocarbon
d) Nitrogen oxides
14. The adverse health effects of Carbon monoxide include:
a) respiratory diseases
b) kidney damage
c) lung cancer
d) asphyxiation
15. Which gas in the atmosphere causes decay of structural material such as marble and limestone?
a) NO_x b) SO₂ c) CO d) ozone

