國立中山大學108學年度
碩士暨碩士專班招生考試試題

科目名稱：環境工程概論【環工所碩士班】

—作答注意事項—

考試時間：100分鐘

- **考試開始響前不得翻閱試題，並不得書寫、劃記、作答。**請先檢查答案卷（卡）之應考證號碼、桌角號碼、應試科目是否正確，如有不同立即請監試人員處理。
- **答案卷限用藍、黑色筆(含鉛筆)書寫、繪圖或標示**，可攜帶橡皮擦、無色透明無文字墊板、尺規、修正液（帶）、手錶(未附計算器者)。每人每節限使用一份答案卷，不得另攜帶紙張，請衡酌作答。
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科目名稱：環境工程概論【環工所碩士班】　　題號：433002

※本科目依簡章規定「可以」使用計算機（廠牌、功能不拘）（混合題）　　

Section A – Choose the only correct answer for each statement.
(60 total points, 4 points per question)

1. What are the two main gases produced by human activity that enhance the greenhouse effect?
(A) carbon dioxide and ozone (B) methane and carbon dioxide (C) carbon dioxide and water vapor
(D) carbon dioxide and sulfur dioxide

2. A former metals plating shop is to be redeveloped but there is extensive contamination of the soils by heavy metals. Which of the following technologies would you expect to be most effective in remediating the soil contamination at this site?
(A) soil-vapor extraction (B) solidification/stabilization (C) bioremediation (D) thermal desorption

3. Which one of the following techniques could reduce emissions of sulfur dioxide gas from an industrial chimney?
(A) water sprayers (B) paper filters (C) high-temperature heaters (D) electrostatic particle collectors

4. The key aim of an Environmental Risk Assessment is to
(A) determine some of the possible human health risks of an environmental project. (B) continually assess and monitor environmental problems associated with an environmental project. (C) create an objective analysis and compare the relative risks of a particular activity to an ecosystem. (D) assess and quantify key factors that would be of benefit to the environment if a particular project were developed.

5. A pollutant that moves long distances through the environment by an airborne transport mechanism would most likely
(A) be water soluble. (B) have a high boiling point. (C) be a gas at room temperature.
(D) be denser than the atmosphere.

6. Kenny conducted an Environmental Risk Assessment to evaluate the possible impacts of releasing various levels of a particular pollutant from a chemical processing plant. An Environmental Risk Assessment should focus on
(A) an outline of the beneficial properties of the products produced by the processing plant.
(B) the legislative requirements related to the human health effects as a result of exposure to the pollutant.
(C) the quantification of potential hazards to the local environment of the processing plant releasing this pollutant.
(D) a detailed outline of the management processes required to reduce the health effects related to exposure to the pollutant.

7. Scrubbers commonly used in the chimney stacks of coal-fired power plants can prevent emission of 45% of the heavy metal particulates released from combusted coal. One ton of coal (1000 kg) releases on average 500 mg of mercury particulates when burned without scrubbers. The mass of mercury emitted from 25 tons of coal when combusted in the presence of scrubbers is closest to
(A) 6375 mg (B) 6875 mg (C) 8675 mg (D) 12575 mg

The following information relates to Questions 8-10.
Bioethanol is a renewable liquid fuel made from crops such as corn and sugar cane. It can be added to standard unleaded petrol at low concentrations. Bioethanol is considered by some people to be 100% carbon neutral – this means that all the carbon that is emitted while using it as fuel can eventually be recycled back into the next plant crop as it grows. Other people argue that bioethanol can never be completely carbon neutral if the life-cycle costs of the fuel are considered.

8. As it relates to bioethanol production, a Life Cycle Analysis attempts to
(A) assess the impact of producing bioethanol on the breeding patterns of animals and humans.
(B) measure all the adverse effects on human and environmental health of producing bioethanol.
(C) quantify all environmental impacts of the supply and use of raw materials and wastes in producing bioethanol.
(D) describe the risks associated with producing bioethanol, including pollution and environmental degradation.

9. The burning of bioethanol produces high quantities of aldehyde chemicals, which contribute to photochemical smog. In spring, when both photochemical smog and pollen are present, the occurrence of asthma can be much higher. This is an example of
(A) persistence. (B) bioaccumulation. (C) chronic exposure. (D) synergistic action.

10. The arguments for and against the use of bioethanol as an additive to unleaded petrol are being debated in the media. The major role of community and environmental interest groups in this debate is to
(A) produce a Life Cycle Analysis. (B) maintain the profitability of petrol companies.
(C) encourage responsible environmental practices. (D) assess the consequences of regulatory frameworks.

The following information relates to Questions 11 and 12.
A large mobile phone manufacturing company has undertaken an investigation of its production techniques, including the extraction of the raw materials and an evaluation of the energy required to produce, transport and use its products.

11. This investigation could best be described as
(A) a regulatory framework. (B) an Environmental Impact Assessment.
(C) an Environmental Management System. (D) an ecologically sustainable development.

12. The company also developed a mobile phone recycling plan which included a study of the potential risks of disposal methods, the possible impacts on the environment and the effects pollutants could have on human health. The plan included actions to stop discarded phones ending up in landfill, where toxic heavy metals can leach into the soil. This plan could best be described as
(A) an ecologically sustainable development. (B) a waste minimization scheme.
(C) a regulatory framework. (D) a Life Cycle Analysis.

Use the following information to answer Questions 13-15.
An electricity-generating power station in the Taichung City is powered by coal. The coal is burned in a boiler to produce steam, which drives a turbine to turn a generator. The steps involved in the process and the percentage efficiency of each step are shown in Figure 1.

Figure 1

13. The operation of the generator is an example of the conversion of
(A) kinetic to potential energy. (B) kinetic to electrical energy. (C) electrical to potential energy.
(D) chemical to electrical energy.

背面有題

14. The overall percentage energy efficiency of the conversion of coal to electrical energy in the power station is approximately
(A) 26% (B) 30% (C) 95% (D) 89%

15. Environmentalists suggest that the power station be converted to burn natural gas. The most likely reason for this is that natural gas
(A) is renewable, whereas coal is not. (B) is more readily available and easier to extract than coal.
(C) produces less pollution per unit of energy produced than coal.
(D) is not a fossil fuel, but coal is a fossil fuel.

Section B – Short answer questions.
(40 total points)

1. A wastewater sample is being analyzed to determine its BOD content. The sample is diluted in order to perform the test: 295 mL of distilled water are added to 5 mL of sample to fill the 300 mL BOD bottle. The bottle has an initial dissolved oxygen concentration of 7.9 mg/L. After incubating 5 days, the dissolved oxygen concentration is 4.5 mg/L.
(a) What is the 5-day BOD of the wastewater? (5 points)
(b) The deoxygenation rate constant k is 0.013 day^{-1}.
What is the ultimate BOD of the wastewater? (5 points)

2. Your site is contaminated by a mix of chemical contaminants, including nitrate, perchloroethylene, carbon tetrachloride, benzene, toluene, and petroleum hydrocarbons. The site is located downgradient of a landfill, and degradation of organic matter in the landfill leachate has removed the dissolved oxygen from the ground water. Which of the chemicals in the mix above would you expect to be biodegraded in these circumstances? (6 points)

3. Briefly describe two engineering control methods that may be used to control VOC emissions. For each method, briefly provide two advantages and two limitations of the method. (12 points)

4. If you are the director of Environmental Protection Bureau Kaohsiung City Government, please answer the following questions.
(a) What strategies or policies will you use for improving the air quality of Kaohsiung City? (6 points)
(b) If the government builds a Love Wonder Wheel near the river. What environmental issues may be caused and how do you prevent them from happening? (6 points)

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科目名稱：工程數學【環工所碩士班】　　題號：433001

※本科目依簡章規定「可以」使用計算機（廠牌、功能不拘）（問答申論題）　　

1. 請解下列微分方程式：（15分）

$$\frac{dy}{dx}=\frac{x(y^2+1)}{y(x^2-1)}$$

2. 一湖泊中污染物濃度為C[公克/公升]，一污染源將該污染物排放至湖泊中的排放速率為S[公克/公升-小時]，該污染物在湖泊中的降解速率常數為L[1/小時]。當時間t[小時]等於t_0[小時]，濃度C為初始濃度C_0[公克/公升]。請根據下列微分方程式，求出湖泊中濃度C與時間t之關係方程式（方程式中應包含C_0、t_0、S、以及L各參數）：（15分）

$$\frac{dC}{dt}=S-LC$$

3. 試以反矩陣解下列線性方程式：（20分）

$$\begin{cases}2x+y-z=7\\x-3y+z=3\\x+3y-3z=1\end{cases}$$

4. 已知一曲面方程式$xy^2-2xy+4z^2=4$，請求出：（a）在點（2,1,1）處之單位法向量；（10分）（b）在點（2,1,1）處之切平面方程式。（10分）

5. 已知$z=ax+by^2-a$，請以偏微分法消去任意常數a,b以形成一偏微分方程式。（15分）

6. 請解出下列偏微分方程式：（15分）

$$\frac{\partial u}{\partial y}=x\cos y$$
$$u(x,0)=\tan x$$

試題請隨卷繳回