

# 國立中山大學 109 學年度 碩士暨碩士專班招生考試試題

科目名稱：工程數學【環工所碩士班】

## — 作答注意事項 —

考試時間：100 分鐘

- 考試開始鈴響前不得翻閱試題，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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# 國立中山大學 109 學年度碩士暨碩士專班招生考試試題

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）

共 1 頁第 1 頁

1. 解下列微分方程式：（15%）

$$y'' - 4y' + 4y = e^{3x}$$

2. 試求下列函數之拉普拉斯轉換：（15%）

$$f(t) = e^{5t+3}$$

3. 已知  $A = \begin{bmatrix} 1 & 2 & 3 \\ 2 & 4 & 0 \\ 4 & 8 & 1 \end{bmatrix}$ ，試求：（20%）

- 餘因子矩陣（Matrix of Cofactor）（6%）
- 伴隨矩陣（Adjoint Matrix）（6%）
- 證明此矩陣為奇異方陣（Singular Matrix）（8%）

4. 試解下列微分方程式系統之解：（15%）

$$\begin{cases} \frac{dy}{dt} = -x \\ \frac{dx}{dt} = 1 - 9y \end{cases}$$

$$y(0) = x(0) = 0$$

5. 若曲面  $x^2 - y^2 + 2xz = 4$  與  $4xz^2 - y^3 = 15$  在交點  $(1, 1, 2)$  之夾角為  $\theta$ ，試求  $\cos \theta$  之數值。（15%）

6. 試以分離變數法（或其他方法亦可）解下列一階偏微分方程式：（20%）

$$\frac{\partial u}{\partial u} + \frac{\partial u}{\partial x} = xu$$

$$x > 0, t > 0$$

$$\text{邊界條件為 } u(0, t) = 2e^{-2t}$$

# 國立中山大學 109 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】

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# 國立中山大學 109 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】

題號：433002

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Section A – Choose the only correct answer for each statement.

(75 total points, 3 points per question)

1. Disinfection efficiency is ( )?

- A. Reduced at higher pH value of water
- B. Unaffected by pH value of water
- C. Increased at higher pH value of water
- D. Highest at pH value equal to 7

2. Which one of the following lists contains only non-fossil energy sources?

- A. Coal, nuclear, natural gas, wind
- B. Nuclear, hydro-electric, wind, solar
- C. Hydro-electric, solar, wind, natural gas
- D. Nuclear, hydro-electric, oil, wind

3. Two monitoring wells were constructed in an unconfined aquifer. The wells are separated by a distance of 250 ft. The water surface elevations in the up-gradient and down-gradient wells were 101.00 ft and 100.85 ft, respectively. The aquifer hydraulic conductivity is 5 ft/day. The fluid velocity (ft/day) in the aquifer is most nearly:

- A. 1.5
- B. 0.75
- C. 0.003
- D. 0.0006

4. Which of the following devices is not used to control particulate emissions?

- A. Electrostatic precipitator
- B. Bag filter
- C. Catalytic converter
- D. All of the mentioned

5. A gas mixture at 25°C and 1 atm contains 100 mg/L of H<sub>2</sub>S. The partial pressure (atm) exerted by the H<sub>2</sub>S is most nearly:

- A. 0.14
- B. 0.072
- C. 0.0056
- D. 0.0029

6. What does the aerodynamic diameter of an aerosol indicate?

- A. Size of the aerosol particle when floating in air.
- B. Equivalent diameter of a sphere having same volume as that of the aerosol.
- C. Average diameter of aerosol particles present in unit volume of air.
- D. Maximum size of aerosol particle that can float in the air.

7. Which of the following is associated with the corrosion of sanitary sewers?

- A. H<sub>2</sub>S
- B. BOD
- C. NH<sub>3</sub>
- D. Ozone

8. The correct relation between Theoretical oxygen demand (TOD), Biochemical oxygen demand (BOD) and Chemical oxygen demand (COD) is given by:

- A. TOD > BOD > COD
- B. BOD > COD > TOD
- C. TOD > COD > BOD
- D. COD > BOD > TOD

9. A heat exchanger is designed to heat liquid water from 150°C to 190°C inside tubes using steam condensing at 230°C on the outer surface of the tubes. For a constant flow rate, the effect of fouling of the heat transfer surfaces is to:

- A. increase the temperature rise of the water.
- B. decrease the temperature rise of the water.
- C. increase heat exchanger effectiveness.
- D. make no change in heat exchanger effectiveness.

10. Which of the following can be considered in Environmental Risk Assessment?

- A. Exposure period
- B. Potency of a toxic material
- C. Quality of models
- D. All of the above

11. Which of the following is a liquid form of aerosol?

- A. Fume
- B. Dust
- C. Smoke
- D. Mist

試題請隨卷繳回，請留意背面是否有題

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科目名稱：環境工程概論【環工所碩士班】

題號：433002

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12. Which of the following laws states that the solubility of a gas in a liquid is proportional to the partial pressure of that gas in contact with liquid?  
A. Hick's law  
B. Henry's law  
C. Hardy-Weinburg law of equilibrium  
D. 2nd Law of Newton
13. For coal-fired steam electric power plants, control of SO<sub>x</sub> emissions is most commonly achieved by?  
A. Catalytic conversion B. Electrostatic precipitation C. Carbon adsorption D. Lime scrubbing
14. Which bacteria results in the corrosion of iron and steel pipes embedded in soil?  
A. Iron bacteria B. Sulphur bacteria C. Escherichia coli bacteria D. Bacterium coli bacteria
15. Which of the following air pollution control device has maximum efficiency?  
A. Electrostatic precipitator B. Dynamic precipitator C. Spray tower D. Wet cyclonic scrubber
16. The ration of 5 day BOD to ultimate BOD is about?  
A. 1/3 B. 2/3 C. 3/4 D. 1.0
17. The settling velocity of a particle in a sedimentation tank depends on?  
A. Depth of tank B. Surface area of tank C. Both depth and surface area of tank D. None of the above
18. Which of the following parameters is not a good indicator of contamination in ground water?  
A. BOD B. Nitrates C. Silica D. Chlorides
19. For the same solid content, if the quantity of sludge with moisture content of 98% is X, then the quantity of sludge with moisture content of 96% will be?  
A. X B. X/2 C. 3X/4 D. X/4
20. Flue gas laden with fine particles from a thermal power plant with a volume flow rate of 100 m<sup>3</sup>/second passes through an electrostatic precipitator (ESP) having 5000 m<sup>2</sup> of collector plate area. If the particle collection efficiency of the ESP is 98%, the drift velocity of the flue gas must be?  
A. ~ 0.052 m/s B. ~ 0.078 m/s C. ~ 0.15 m/s D. ~ 1.5 m/s
21. In Environmental assessment study, interpretation and evaluation should consider?  
A. Uncertainty of possible impacts.  
B. Significance of measured impacts.  
C. Comparison of alternatives.  
D. All of the above.
22. Biogas produced by anaerobic bacterial activity is a mixture of?  
A. CH<sub>3</sub>OH, CO<sub>2</sub>, NH<sub>3</sub> and H<sub>2</sub>O  
B. CH<sub>4</sub>, CO<sub>2</sub>, NH<sub>3</sub>, H<sub>2</sub>S and H<sub>2</sub>O  
C. H<sub>2</sub>S, CO<sub>2</sub>, CO, CH<sub>4</sub> and LPG  
D. CO<sub>2</sub>, SO<sub>2</sub>, NO<sub>2</sub>, CH<sub>4</sub> and H<sub>2</sub>O
23. The biodegradability of xenobiotics can be characterized by?  
A. Rate of CO<sub>2</sub> formation  
B. Rate of O<sub>2</sub> consumption  
C. Ratio of BOD to COD

試題請隨卷繳回，請留意背面是否有題

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共 3 頁 第 3 頁

D. All of the above

24. Solid waste treatment by pyrolysis involves

- A. Autoclaving
- B. Heating in presence of air
- C. Heating in presence of H<sub>2</sub>O
- D. Heating in absence of air

25. Which one of the following is a waste recycling method of solid waste management?

- A. Pelletisation
- B. Composting
- C. Incineration
- D. Sanitary Landfill

**Section B – Short answer questions.**

**(25 total points)**

1. What is PM 2.5 and PM 10? How they affect health? (9 points)
  
2. What is the concentration of H<sup>+</sup> ions in moles/L in water if the pOH value is 6? (5 points)
  
3. What is noise? Describe briefly the effects of noise on human health? How to control noise pollution? (11 points)