國立中山大學九十學年度碩博士班招生考試試題

科目：工程數學【環工所碩士班】

1.試求解下列微分方程式

(1)

$$y' = \frac{y-x+1}{y-x+5}$$

y(0)=4 (15 points)

(2) $y'' - 9y = e^{3x}$ (15 points)

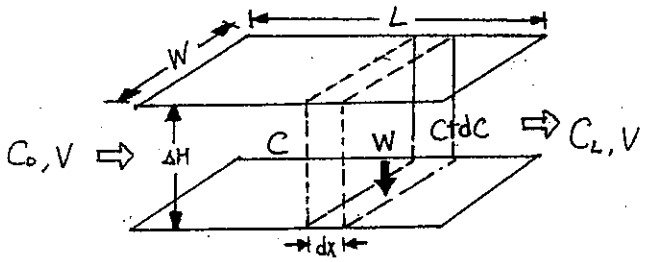
2.某含塵廢氣以流速 V 均勻流經一重力沈降器(見下圖),若已知粉塵大小一致，其沈降速度爲 W，入口處及出口處粉塵濃度分別爲 C_o 及 C_L。假設粉塵在沈降器內均勻混合，試回答下列問題:

(1) 請以質量守恆原理列出微分方程式。(10 points)

(2) 請推導沈降器之除塵效率公式爲

$\eta = 1 - \exp[-(WL/VH)]$

(10 points)



3. What is the rate of change of the following equation

$$f(x,y) = 3x^2 + xy - 2y^2$$

at the point (1, -2) in the direction 4**i** +3**j** ? (15 points)

4. Please find the Fourier series for

$$f(t) = \begin{cases} 1 & 0 < t < \pi \\ 0 & \pi < t < 2\pi \end{cases}$$

(15 points)

5. What are the Laplace transformations of

(1) $f(t) = e^{at}$ (10 points)

(2) $f(t) = e^{-2t}\cos 6t$ (10 points)

國立中山大學九十學年度碩博士班招生考試試題

科目：環境工程概論【環工所碩士班】

(20%) 1、名詞解釋：

(1)Destruction and removal efficiency (4%)

(2)Cleaner production (4%)

(3)Solidfication/stabilization (4%)

(4)Flexible membrane liner (4%)

(5)Waste exchange (4%)

(20%) 2、請比較下列名詞：

(1)污染預防(pollution prevention)和管末處理(end-of-pipe treatment) (4%)

(2)環境影響說明(environmental impact statement)和環境影響評估(environmental impact assessment) (4%)

(3)溫室效應(greenhouse effect)和熱島效應(heat island effect) (4%)

(4)倫敦型煙霧和洛杉磯型煙霧(smog) (4%)

(5)燻煙型煙柱(fumigation)和扇型煙柱(fanning) (4%)

(15%) 3、(1)請繪圖說明典型快濾水廠之處理流程，並簡述各處理單元之功能。(10%)

(2)某池澱池之溢流率(overflow rate)為 5×10^{-4} $m^3/sec\text{-}m^2$，水深為 3.0 公尺，試求該沈澱池之水力停留時間為多少小時？(5%)

(20%) 4、某工廠每日產生之廢水量為 400 公噸，其水質分析結果如下：(1)pH：9.5；(2)導電度：100 μmhos/cm；(3)化學需氧量：570mg/L；(4)總鹼度：20.53 mg/L as $CaCO_3$；(5)總懸浮固體量：3150 mg/L；(6)固體物之粒徑分佈：96~450 nm 佔 85%，平均值為 220nm；(7)懸浮顆粒之界達電位：-75.0 mV；(8)濁度：120 NTU；(9)外觀：白濁狀。試針對此工業廢水提出二種商業化處理技術，並評估比較其優缺點。(20%)

(12%) 5、請回答下列有關都市垃圾焚化爐相關問題：

(1)垃圾貯坑之臭味如何有效控制或處理？(4%)

(2)煙囪冒白煙時，可採取那些措施加以解決？(4%)

(3)廢氣中戴奧辛之最佳可行控制技術(BACT)為何？(4%)

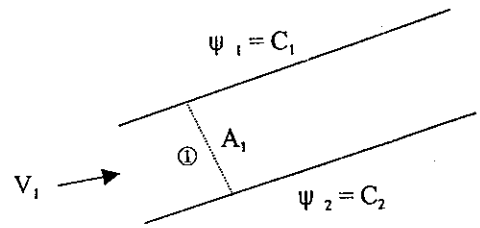
(13%) 6、(1)某袋式集塵器之氣布比(A/C)為 4cm/sec，若欲處理之廢氣流量為 5×10^6 cm^3/sec，則所需濾布面積為多少平方公尺？(6%)

(2)某靜電集塵器之除塵效率擬由 85%提昇至 95%，則其收集板面積需要增加百分之多少？(7%)

國立中山大學九十學年度碩博士班招生考試試題

科目：流體力學【環工所碩士班】甲組

1. (15%) 一流場兩條流線(streamline)之值分別為 $\psi_1 = C_1$，$\psi_2 = C_2$，其在①處之寬度為 A_1，如下所示：



求在①處之速度 V_1。

2. (30%) The hydrostatic pressure distribution in the atmosphere is given by

$$\frac{dp}{dz} = -\rho g$$

where p : pressure, z : height, ρ : air density, g : gravity.

If the vertical temperature drop (the lapse rate) is $\Gamma\left(=-\frac{dT}{dz}\right)$, and air is an ideal gas with a gas constant R. Let the temperature and pressure be T_0 and P_0 at the sea level ($z = 0$). Determine

(a) the temperature $T(z)$.

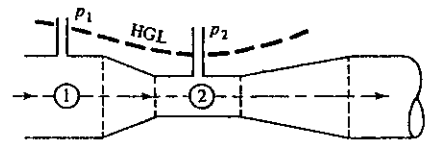
(b) the pressure $P(z)$.

3. (15%) An,incompressible flow field is given by

$$u = Axz^2 \text{ , } w = cy \text{ ,}$$

where A and c are constants; u, w are the velocity components in the x- and z-directions, respectively. Determine the velocity component v in the y-direction.

4. (20%) 如下圖所示，Venturi tube (文氏管)常用來量測兩點之壓差Δ $P=P_1-P_2$，以求得液體之流量。若文氏管為水平放置，液體的密度為 ρ，兩測點之截面積分別為 A_1 及 A_2，且摩擦損失不計，試求其流量 m。



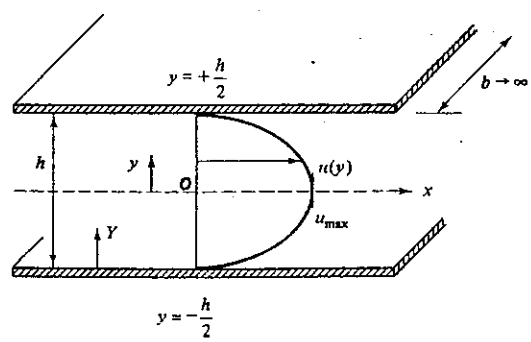
5. (20%) 流場之連續及運動向量方程式分別為

$$\nabla \cdot \vec{V} = 0$$

$$\rho \vec{V} \cdot \nabla \vec{V} = -\nabla p + \mu \nabla^2 \vec{V}$$

上式中，$\vec{V}$：速度向量，p：壓力，μ：黏滯係數

茲有水平放置的兩平行板相隔 h(如下圖所示)，板內液體在 x 方向上有一固定的壓力降 $B = -\dfrac{dP}{dx}$，試求其水平速度 $u(y)$。



國立中山大學九十學年度碩博士班招生考試試題

科目：環境化學【環工所碩士班】乙組

1. (1)Two major techniques commonly used to model soil adsorption or sorption equilibrium processes are the Freundlich approach and the Langmuir approach. Please make a description about these two approaches. (12 points)

   (2) Sorption isotherms have been classified into four types (L-type, S-type, C-type, and H-type), depending on their general shapes. Please make drawing descriptions for these four sorption types. (8 points)

2. A water sample is taken from a stream receiving acid mine drainage. The stream passes through an area containing gypsum, $CaSO_4$. Laboratory analysis shows that the pH of the water is 4, the total concentration of sulfate (SO_4^{-2}) is $6x10^{-3}$ M, and the total concentration of chloride (Cl^-) is $3x10^{-4}$ M.

   (1) Assuming that the only other ionic species present is calcium (Ca^{2+}), what is the calcium concentration in the water? (10 points)

   (2) Will the precipitation reaction occur further downstream? (5 points)

   (Note: $Ca^{2+} + SO_4^{2-} = CaSO_{4\,(s)}$; $K = 10^{4.62}$)

3. The following constituents and concentrations are found in a water sample:

Constituent	Concentrations mg/L
Ca^{2+}	51
Mg^{2+}	17
Na^+	21
K^+	4
Fe^{2+}	0.08
HCO_3^-	181
SO_4^{2-}	30
Cl^-	48
F^-	0.2
NO_3^-	0.2
SiO_2	8.8
Total dissolved solids	271
Total hardness as $CaCO_3$	197
pH	7.1

Please determine:

(1) The calcium, magnesium, and iron hardness expressed as meq/L and as mg/L equivalent $CaCO_3$ (5 points)

(2) The total hardness as meq/L and as mg/L equivalent $CaCO_3$ (5 points)

(3) The alkalinity as meq/L and as mg/L equivalent $CaCO_3$ (5 points)

(4) The nitrate as N (5 points)

(5) The hydrogen and hydroxyl ion concentration in moles/L (5 points)

4. 下列物質對人體造成之症狀或危害為何？（20%）

(1) Cd (2) Hg (3) Pb (4) Ba (5) Cr

(6) CO (7) As (8) NO_3^- (9) Ag (10) 石綿

5. 光化學煙霧與臭氧破洞中 O_3 之角色有何不同？(6%)
NO_2 與 NO 如何破壞臭氧層？(6%)

6. 解釋下列名詞：（8%）

(1) 精密度 (2) 準確度 (3) 實驗室空白 (4) 野外空白