



國立雲林科技大學 104 學年度
碩士班招生考試試題

系所：財金系、環安系、工管系
科目：經濟學

本試題共有六大計算題，每題的配分如各題的開頭所顯示。

1. Suppose that a firm's production function is $Q=LK^2$. The per-unit prices of inputs L and K are \$60 and \$5, respectively.
 - a. (10 points) Determine the optimal combination of inputs and the minimum cost level if the firm wants to produce 3,888 units of output.
 - b. (10 points) The firm chooses the combination of (L, K) as $(12, 18)$ in order to produce 3,888 units of output. As a result, only 3,000 units of output are produced. Please evaluate the firm's allocative and technical efficiency, respectively.

2. The AA Company manufactures product X selling for \$2.98 each. Sales have averaged 10,000 units per month during the last year. Recently AA's closest competitor, BB Company, cut its prices on similar product from \$3.49 to \$2.59. AA noticed that its sales declined to 8,000 units per month after the price cut.
 - a. (5 points) What is the arc cross elasticity of demand between AA's and BB's products?
 - b. (10 points) If AA knows the arc price elasticity of demand for product X is -2.2 , what price would they have to charge in order to obtain the same level of sales as before BB's price cut?

3. (15 points) Two companies (A and B) are duopolists that produce identical products. Demand for the products is given by the following demand function:

$$P = 10,000 - Q_A - Q_B,$$
 where Q_A and Q_B are the quantities sold by the respective firms and P is the selling price. Total cost functions for the two companies are:

$$TC_A = 300,000 + 400Q_A + .5Q_A^2 \text{ and } TC_B = 100,000 + 200Q_B + Q_B^2$$
 Assume that the firms form a cartel to maximize total industry profits. Determine the optimum output and selling price for each firm.



4. Assume that an economy is characterized by the following equations:

$$C = 100 + \left(\frac{2}{3}\right) \cdot (Y - T)$$

$$T = 600$$

$$G = 500$$

$$I = 800 - \left(\frac{50}{3}\right) \cdot r$$

$$\left(\frac{M^s}{P}\right) = \left(\frac{M^d}{P}\right) = 0.5 \cdot Y - 50 \cdot r$$

Where C denotes consumption, Y denotes output, T denotes taxes, G denotes government spendings, I denotes investment, r denotes interest rate, M^s denotes money supply, M^d denotes money demand, and P denotes price.

- (4 points) Write the numerical IS curve for this economy, showing Y as a numerical function of r and other exogenous variables of this model.
 - (4 points) Write the numerical LM curve for this economy, showing r as a function of Y and other exogenous variables of this model.
 - (8 points) Solve for the equilibrium values of Y and r , and the corresponding consumption, and investment, assuming $P=1$ and $M=1200$. How do they change when $P=2$?
 - (4 points) Write the numerical aggregate demand curve for this economy, expressing Y as a function of P and other exogenous variables of this model.
5. Assume that in a small open economy with full employment, consumption depends only on disposable income. National saving is 300, investment is given by $I = 400 - 20 \cdot r$, where r is the real interest rate in percent, and the world interest rate is 10 percent.
- (4 points) If government spending rises by 100, does investment change? What is the level of investment after the change?
 - (4 points) Does the trade balance change if government spending rises by 100? If it changes, does it increase or decrease, and by how much?
 - (4 points) Does net capital outflow change if government spending rises by 100? If it changes, does it increase or decrease, and by how much?
 - (4 points) Will the real exchange rate rise, fall, or remain constant as a result of the change in government spending?



6. Consider an economy where savings follow the rule of thumb that they are a constant fraction s of income, i.e. $S_t = s \cdot Y_t$ with $s \in (0, 1)$. The production function is $Y_t = A_t \cdot L^{1/2}$, where Y denotes output, A denotes technology, L denotes labor, and the labor force is fixed at $L=1$. The growth rate of productivity is g , i.e. $A_{t+1} = (1+g) \cdot A_t$, with $A_0 = 1$. The government spends G_t each period and collects a lump-sum tax of T_t . The economy exists for three periods $t = 0, 1, 2$.
- (2 points) Find the path for private savings $S_t^{priv} = Y_t - T_t - C_t$ and public savings $S_t^{gov} = T_t - G_t$ if $G_t = T_t = 0$ for all t . (i.e. express private savings as a function of s and g .)
 - (2 points) Find the path for private savings if government spending is fixed at a fraction $p \in (0, 1)$ of GDP and the government is running a balanced budget every period. (i.e. express private savings as a function of s and g .)
 - (6 points) Now consider the case where the government spends $G_0 = p \cdot Y_0$ at period 0 and zero in all other periods, and collects taxes $T_2 = p \cdot Y_2$ in period 2 and zero in all other periods. Find private and public savings at each period. (i.e. express private and public savings at each period as a function of s , p and g .)
 - (2 points) Is there Ricardian equivalence in this economy?
 - (2 points) Now assume that aggregate savings S is allowed to depend on G (as well as Y as before.) Find a dependence that S must have on G , so that Ricardian equivalence holds in this economy.



1. 試求下列所予方程式圖形所圍成區域的面積？並求出其形心位置？----- (8%)

$$y = e^{2x}, y = 0, x = -1, x = 0$$

2. 試求解下列問題？

(A) 求 $\lim_{n \rightarrow \infty} \left(\frac{1}{\sqrt{n^2}} + \frac{1}{\sqrt{n^2+n}} + \frac{1}{\sqrt{n^2+2n}} + \dots + \frac{1}{\sqrt{n^2+(n-1)n}} \right)$ 的值？----- (8%)

(B) 求 $\int \frac{e^{x^{\frac{1}{3}}}}{x^{\frac{2}{3}}} dx$?----- (8%)

(C) 求 $\int_0^5 \frac{dx}{\sqrt{25+x^2}}$?----- (8%)

3. 試求解下列問題？

(A) 試作函數 $f(x) = x^3 + 3x^2 + 5$ 的圖形？需標明截距、遞增及遞減區間、相對極值及反曲點。----- (10%)

(B) 求在雙曲線 $x^2 - y^2 = 1$ 上與點 $(0, 2)$ 最接近的點？----- (8%)

4. 求曲線 $x = \sin\theta$, $y = \cos 2\theta$ 與 x -軸所圍成區域的面積。----- (10%)

5. 請利用積分檢驗法判斷下式是收斂？或是發散？----- (10%)

$$\sum_{n=1}^{\infty} \frac{1}{10n+3}$$



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6. 求兩個單位向量使他們同時垂直於 $v_1 = 3i + 4j - 2k$ 與 $v_2 = -3i + 4j + k$ 。(10%)

7. 求題中函數的一階偏導函數。----- (10%)

$$f(x, y, z) = (y^2 + z^2)^x$$

8. 計算題中的疊積分。----- (10%)

$$\int_0^1 \int_0^1 \frac{xy}{\sqrt{x^2 + y^2 + 1}} dy dx$$



1. 已知 ODE 為 $ax^2y'' + bxy' + cy = 0$ ，若令 $y = x^m$ 為其解，(A) 試求 m 之值；(B) 假設 m 為相等實根 (m_1, m_2 are real and equal)，若 $y_1 = x^{m_1}$ ，試證明 $y_2 = y_1 \ln x$
----- (10%)
2. 求解下列 ODE： $(x+3)^2y'' - 8(x+3)y' + 14y = 0$ ----- (10%)
3. 求解下列 ODE： $x^3y''' - 3x^2y'' + 6xy' - 6y = 3 + \ln x^3$ ----- (10%)
4. 試求： $\mathcal{L}\left\{t \int_0^t \tau e^{\tau} d\tau\right\}$ ----- (10%)
5. 試求： $y'(t) = 1 - \sin t - \int_0^t y(\tau) d\tau$, $y(0) = 0$ ----- (10%)
6. 求解下式： $y'' - 2y' + 7 = 0$ ----- (10%)
7. 求解下式： $xy' + 4y = 2x$; $y(1) = -4$ ----- (10%)
8. 求解下式： $y'' - y' - 2y = e^{2x}$ ----- (10%)
9. 使用 Maclaurin 級數求解下列初始值問題，至前五個非零項
 $y'' - e^x y' + 2y = 1$; $y(0) = -3$, $y'(0) = 1$ ----- (10%)
10. 試證明下式為 Laplace equation ($\nabla^2 u = 0$) 之解
 $u = x^4 - 6x^2y^2 + y^4$ ----- (10%)

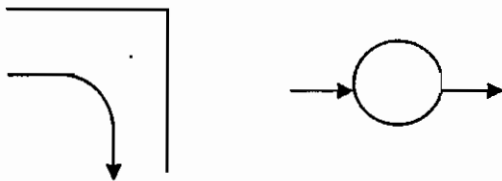


(禁止使用計算機，不易計算出答案之部分，請詳列計算式或過程，另倘有未提供之數據，請進行合理假設)

- 試解釋如下之名詞：(a) hydraulic radius (b) energy grade line。(10%)
- 已知某蓄水池之長、寬與水深分別為 6 m、6 m 與 3 m，試求(a)池底之壓力(Pa) (b)水池側邊受流體作用力的大小(N)。假如該蓄水池所蓄積之液體並非全部為水，而是 1 m 的水與 2 m 的其他液體(其 specific gravity 為 2)，試求(c)水池側邊受流體作用力的大小(N)。(15%)
- 某抽水機將 A 池(水面高程為 84 m) 流量 0.3 m³/s 之水，以直徑 600 mm 管線 ($f=0.01$) 送至 5 公里外之 B 池(水面高程 91 m)，試求(a)抽水機之總揚程(m) (b)抽水機之理論水動力(water power)(W)。(彎管等次要損失水頭不計) (15%)
- 某流量為 0.2 m³/s 之水管，其管徑 400 mm、管長 500 m、 $f=0.01$ ，假如該管線前端之高程為 95 m，壓力為 120 kN/m²，管線末端之高程為 99 m，試問管線末端之壓力(kN/m²)為何？(10%)
- 何謂水錘效應？主要影響因子為何？如何減少其作用？(10%)
- 請劃出下列流場之理想層流及紊流流線。(10%)

(1)

(2)



- 一 1m 半徑之圓槽體內部抽成 50% 真空 (0.5 大氣壓) 時，槽體外部總受力多少？(10%) (提示：1 atm=101.325 kPa=1.01325 bar=760 mmHg=1.03323 kgf/cm²)
- 強烈颱風之颱風眼氣壓 560 mmHg，暴風半徑 100 公里最大風速 200 km/hr，海水密度 1025 kg/m³，水銀為密度 13600 kg/m³，海平面空氣密度 1.2 kg/m³，請問因氣壓差引起之海面上升多少？因最大暴風引起之海面上升為多少？(10%) (提示：白弩利 Bernoulli 方程式)



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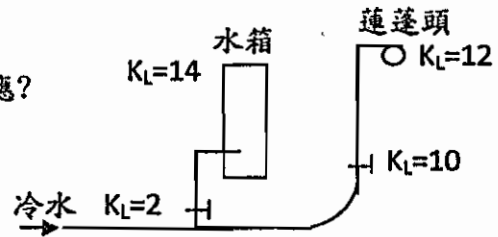
系所：環安系
科目：流體力學(2)

9. 冷水以 100 kPa 壓力流入 2 公分直徑之管線，
不計長度及轉變水頭損失。(10%)

- (1) 請說明若水箱沖水會造成什麼效應？
(2) 蓮蓬頭水頭損失應如何計算？

提示：Colebrook eq 紊流

$$\frac{1}{\sqrt{f}} = -2.0 \log \left(\frac{\epsilon}{3.7D} + \frac{2.51}{Re\sqrt{f}} \right)$$



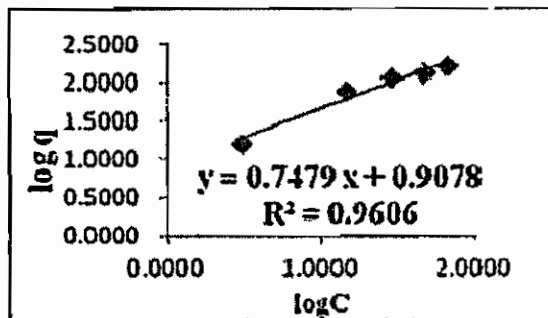


一、名詞解釋 (10 分，5 分/題)

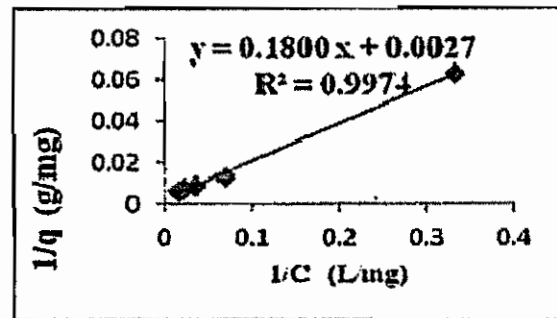
1. Thermal death point
2. Antibiotic

二、計算與問答題 (90 分，7 題)

1. 水樣中可被生物分解的有機物質，其濃度 C_0 為 37 mg/L，已知化學式為 $C_6H_{11}ON_2$ ，計算氧化(其中 N 氧化為氨即可)該有機物所需之氧量 L_0 。(C: 12 g/mol, H: 1 g/mol, O: 16 g/mol, N: 14.0 g/mol) (15 分)
2. 於 25°C 下，加 Na_2HPO_4 於水中至總濃度為 $10^{-4} M$ ， $K_{a1}=7.5 \times 10^{-3}$ ， $K_{a2}=6.2 \times 10^{-8}$ ， $K_{a3}=4.8 \times 10^{-13}$ 設其完全溶解，請依序寫出(1)質量平衡式(2)電荷平衡式(3)可能進行之反應。(15 分)
3. 一電鍍廢水含 317 mg/L Cu^{2+} ，欲用 $Cu(OH)_2$ 使其沈降到 3 mg/L Cu^{2+} ，問溶液中 OH^- 濃度應升到多少 mole/L？請寫至最後解 OH^- 濃度之方程式。(Cu: 63.5 g/mol, $K_{sp}=2 \times 10^{-19}$) (10 分)
4. 一組用於評斷等溫吸附方程式的數據，經計算及線性回歸後如下圖一、二。請問此可判斷為適用 Langmuir 或 Freundlich 吸附方程式？為什麼？並請寫出該吸附方程式。(10 分)



圖一



圖二

5. 環境微生物的關係主要可分成共生與非共生兩大類，其中的非共生關係又可分成哪兩種？請說明之。(10 分)



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科目：環境化學及環境微生物

6. 微生物獲得 ATP 的三種方式為何？請說明之。(10 分)
7. 請繪出微生物生長曲線，標出曲線中的四個生長時期並說明之。(20 分)