大同大學 105 學年度（暑）轉學入學考試試題

考試科目：工程數學　　　　　系別：化學工程學系　　　第全頁

註：本次考試　不可以參考自己的書籍及筆記；　不可以使用字典；　不可以使用計算器。

請將所有答案在答案本上依序作答，1~10為單選題，每題4%，沒有答案寫O，11題以後為計算題
以下各題 c, n, m, L 為正整數，c_1, c_2 為任意常數

1. For n = m, $\int_{-L}^{L} \cos(\frac{n\pi x}{L}) \cos\left(\frac{m\pi x}{L}\right) dx = ?$ (A)0 (B)π (C)L (D)x (E)L/2

2. ，For n ≠ m, $\int_{-L}^{L} \cos(\frac{n\pi x}{L}) \cos\left(\frac{m\pi x}{L}\right) dx = ?$ (A)0 (B)π (C)L (D)x (E)L/2

3. $\int_{-L}^{L} \cos(\frac{n\pi x}{L}) \sin\left(\frac{m\pi x}{L}\right) dx = ?$ (A)x (B)π (C)L (D) 0 (E)L/2

4. The domains of x variable for a function f(x) to perform Fourier series are (A) $0 \le x \le L$ (B) $-L < x < 0$ (C) $-L \le x \le L$ (D) $-\infty \le x \le \infty$ (E) $x \in R$

5. The function exp(3x) defined in $-\pi \le x \le \pi$ is (A)odd (B)even (C)both even and odd (D)none of above (E)not define

6. Solve $\frac{dT}{dt} + \frac{n\pi c}{L}T = 0$　　(A)$T(t) = c_1 \cos\left(\frac{n\pi c}{L}t\right) + c_2 \sin\left(\frac{n\pi c}{L}t\right)$ (B) $T(t) = c_1 e^{\frac{n\pi c t}{L}} + c_2 e^{-\frac{n\pi c t}{L}}$
   (C) $T(t) = c_1 e^{-\frac{n\pi c t}{L}}$ (D) $T(t) = c_1 e^{\frac{n\pi c t}{L}}$ (E) $T(t) = c_1 t + c_2$

7. Solve $\frac{d^2T}{dt^2} + \frac{n^2\pi^2 c^2}{L^2}T = 0$ (A)$T(t) = c_1 \cos\left(\frac{n\pi c}{L}t\right) + c_2 \sin\left(\frac{n\pi c}{L}t\right)$ (B) $T(t) = c_1 e^{\frac{n\pi c t}{L}} + c_2 e^{-\frac{n\pi c t}{L}}$
   (C) $T(t) = c_1 e^{-\frac{n\pi c t}{L}}$ (D) $T(t) = c_1 e^{\frac{n\pi c t}{L}}$ (E) $T(t) = c_1 t + c_2$

8. Solve $\frac{d^2T}{dt^2} - \frac{n^2\pi^2 c^2}{L^2}T = 0$ (A)$T(t) = c_1 \cos\left(\frac{n\pi c}{L}t\right) + c_2 \sin\left(\frac{n\pi c}{L}t\right)$ (B) $T(t) = c_1 e^{\frac{n\pi c t}{L}} + c_2 e^{-\frac{n\pi c t}{L}}$
   (C) $T(t) = c_1 e^{-\frac{n\pi c t}{L}}$ (D) $T(t) = c_1 e^{\frac{n\pi c t}{L}}$ (E) $T(t) = c_1 t + c_2$

9. The wave equation for one dimensional elastic string is (A) $\frac{\partial u}{\partial t} = k\frac{\partial^2 u}{\partial x^2}$ (B) $\frac{\partial^2 y}{\partial t^2} = c^2 \frac{\partial^2 y}{\partial x^2}$ (C) $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = 0$ (D) $\frac{\partial u}{\partial t} = \frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2}$ (E) $u'' + 3u = 0$

10. The boundary conditions for 1 dimensional heat equation with insulated end at x = L (A) $u(0,t) = 0$ (B) $u(L,t) = 0$ (C) $\frac{\partial y}{\partial t}(x,0) = 0$ (D) $u(x,0) = 20x(\pi - x)$ (E) $\frac{\partial u}{\partial x}(L,t) = 0$

11~14題為計算題，詳列計算過程

11. (15%) Solve $y' + \frac{5y}{9x} = 3x^3 + x$; y(1) = 4

12. (15%) Solve $y'' - 6y' + 9y = 3e^{6x} - 9e^{3x}$

13. (15%) Find the Laplace transform for the function $f(t) = \cos\left(2t + \frac{\pi}{4}\right)$

14. (15%) Find the inverse Laplace transform for the function $Y(s) = \frac{3s+9}{s^2+2s+5}$