海洋大學河海工程學系九十四學年度 第二學期 ■期中 □小考 考試命題紙

考 試 科 目	開課系級	考試日期	印製份數	答案紙	命題教師	備 註
工程數學二	二 A, B	5 月 12 日	110	■ 需 □不需	陳桂鴻 呂學育	第二次大考

1. $y''(t)+\omega^2 y(t)=F(t)$ where $F(t)=\begin{cases}1, & t\in(0,\pi)\\ 0, & t\in(\pi,2\pi)\end{cases}$ and $F(t)=F(t+2\pi)$. (20%)

(a) Find $y_p(t)$ by using the complex Fourier expansion. (10%)

(b) Plot the frequency spectrum of $y_p(t)$. (5%)

(c) Choice the right answer and explain why when cause the phenomenon of Resonance as (5%)

(1) ω is odd numbers. (2) ω is even numbers.

(3) ω is integer numbers. (4) The resonance will not occur.

2. Suppose a uniform beam of length L is simply supported at x=0 and at x=L. If the load per unit length is given by $r(x)=\begin{cases}0, & 0<x<L\\ w_0(x-L), & L<x<2L\\ 0, & 2L<x<3L\end{cases}$, $0<x<3L$, $r(x+3L)=r(x)$, and then the differential equation for the deflection $y(x)$ is $EI\dfrac{d^4y}{dx^4}=r(x)$, where E, I, and w_0 are constants. (40%)

(a) Find the homogenous solution y_h. (5%)

(b) Expand $r(x)$ in a half-range cosine series. (7%)

(c) Find a particular solution $y_p(x)$ by using the Fourier series expansion.(10%)

(d) Expand $r(x)$ in a complex Fourier series and plot frequency spectrum of $r(x)$. (8%)

(e) Find a particular solution $y_p(x)$ by using the complex Fourier series expansion. (10%)

3. Consider $f(x)=x+\pi,\quad -\pi<x<\pi$

(1) determine whether the function f is even, odd, or neither (3 scores)

(2) find the Fourier series of f on the given interval $(-\pi,\pi)$ (8 scores)

(3) give the values that the series will converge at $x=-\pi,\ 0,\ \pi/2,\ \pi$ (4 scores)

(4) use the result of (2) to show $\dfrac{\pi}{4}=1-\dfrac{1}{3}+\dfrac{1}{5}-\dfrac{1}{7}+\dots$ (5 scores)

4. Expand $f(x)=\begin{cases}x & for & 0\le x\le L/2\\ L-x & for & L/2<x\le L\end{cases}$

(1) in a sine series AND give the value that the series will converge at $x=L$ (10 scores)

(2) in a cosine series AND give the value that the series will converge at $x=L$ (10 scores)

5. $f(x)=\begin{cases}-1, & -2<x<0\\ 1, & 0<x<2\end{cases}$

(1) find the complex Fourier series of f on the given interval (10 scores)

(2) find the frequency spectrum of the periodic wave that is the periodic extension of the function f (10 scores)