

本科目可以使用計算機

本科目試題共 1 頁

1. Please find complex Fourier integral of
- $f(x)$
- (20)

$$f(x) = e^{-|x|}$$

2. Please find the principle stresses (Eigen value) and their orientation (Eigenvectors) given
- $\sigma_x = 10, \sigma_y = 50, \tau_{xy} = 10$
- (20).

3. Equation of motion can be expressed as

$$\frac{\partial^2 u}{\partial z^2} = \frac{1}{c^2} \frac{\partial^2 u}{\partial t^2}$$

Where  $c$  is wave velocity. Please solve it for a harmonic motion vibration with frequency  $\omega$  (i.e. assuming  $u(z,t) = U(z)e^{i\omega t}$ ) given boundary condition:  $\frac{\partial u}{\partial z} = 0$  at  $z=0$ ,  $u=0$  at  $z=10$  (20).

4. According to Terzaghi's bearing capacity theory, the ultimate bearing capacity (
- $q_u$
- ) can be expressed as:

$$q_u = cN_c + qN_q + 0.5BN_r$$

Where  $N_c = \frac{Nq-1}{\tan \phi}$  and  $N_q = \frac{e^{2\left(\frac{3\pi}{4} - \frac{\phi}{2}\right)\tan \phi}}{2\cos^2\left(\frac{\pi}{4} + \frac{\phi}{2}\right)}$

Please find  $N_c$  given  $\phi=0$ . (20)

5. The differential equation of long pile is expressed as

$$EI \frac{d^4 y}{dx^4} + ky = 0$$

Where  $EI$  is bending stiffness of pile and  $k$  is stiffness of soil. Please solve the equation given the following boundary equation. (20)

$$\begin{aligned} x=0, EI \frac{d^3 y}{dx^3} &= P \\ x=0, EI \frac{d^2 y}{dx^2} &= 0 \\ x=\infty, y &= 0 \end{aligned}$$