

國立中興大學 104 學年度碩士班招生考試試題

科目：工程數學

系所：土木工程學系丙組

本科目可以使用計算機

本科目試題共 1 頁

1. Please find the principle stresses (Eigen value) and their orientation (Eigenvectors) given  $\sigma_x = 30, \sigma_y = 50, \tau_{xy} = 10$  (20).

2. Please find Fourier integral of  $f(x)$  (20)

$$f(x) = \begin{cases} 1, & |x| < 1 \\ 0, & |x| \geq 1 \end{cases}$$

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:

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

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

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

5. Please find the particular solution (steady state solution) of the equation of motion and express your answer in terms of  $m$ ,  $c$  and  $k$

$$m\ddot{u} + c\dot{u} + ku = \cos \omega t$$

Where  $m$  is mass,  $c$  is damping, and  $k$  is stiffness (20)