

# 國立嘉義大學九十五學年度

## 土木與水資源工程學系碩士班招生考試試題

### 科目：工程數學

(如條件不足，請自行假設，不可使用計算機。)

1. Compute the gradient of function  $f(x, y, z) = x^2 yz$ , and evaluate the gradient at point (1,1,1). Determine at this point the maximum and minimum rates of change of the function. (20%)
2. Use the separation of variables method to solve  $u_{xy} - u = 0$  where  $u_{xy} = \frac{\partial^2 u}{\partial x \partial y}$  and  $u = u(x, y)$ . (20%)
3. Explain how Laplace Transformation transforms t domain of function f(t) to s domain of function F(s) using its definition  $F(s) = \int_0^\infty f(t) \cdot e^{-st} dt$ . (20%)
4.  $\sigma_x, \sigma_y$  are the bi-axial stresses and  $\tau_{xy} = \tau_{yx}$  is the shear stress, as shown in Fig-1. Derive the principal stresses and principal unit vectors using eigenvalues and eigenvectors. (20%)

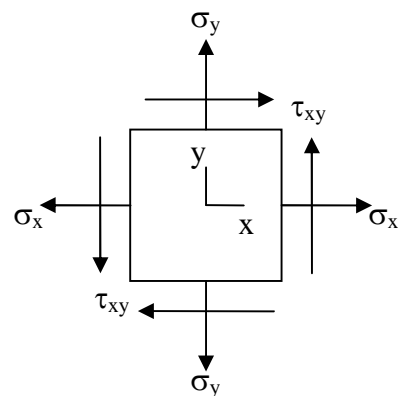


Fig-1

5. A periodic function  $f(x) = f(x + 2\pi)$  with an average value of  $\pi^2/6$ , known  $f(x), f'(x), f''(x)$  as shown in Fig-2~4, and a zero  $f'''(x)$ . Derive  $f(x)$  using the Fourier Series. (20%)

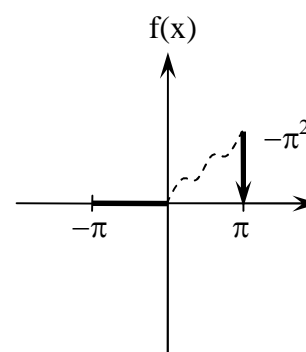


Fig-2

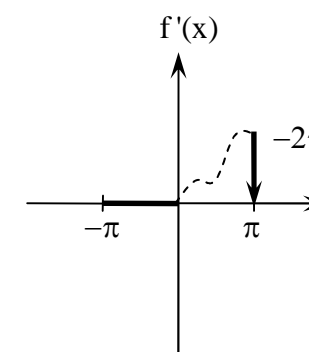


Fig-3

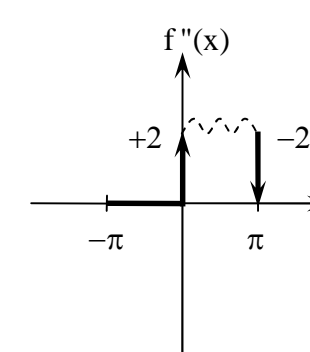


Fig-4