1. (a) What is the assumption regarding the deformation associated with pure bending? (5%)

(b) What is the neutral axis? In which condition the neutral axis does not coincide with the geometric central axis? (5%)

(c) Explain the buckling phenomenon. (5%)

(d) What is the principle of stationary potential energy? (5%)

2. A beam supported as in Fig. 2.1 is subjected to an axial load N and a uniform distributed load w. Derived the governing differential equation of the system and state the boundary conditions.

E: Young's modulus, I: moment of inertia

k: spring constant

(15%)

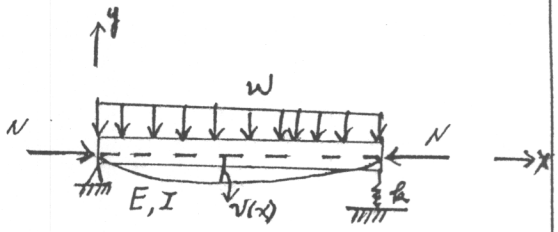


Fig. 2.1

3. Determine the deflection v(x) of the beam in Fig. 2.2 (Using the fourth order equation $EIv'''' + w = 0$)

(15%)

E: Young's modulus

I: moment of inertia

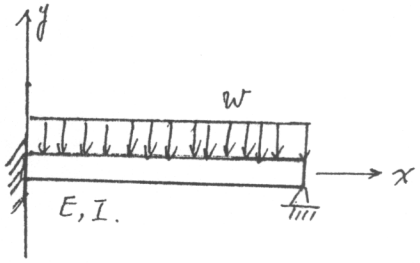
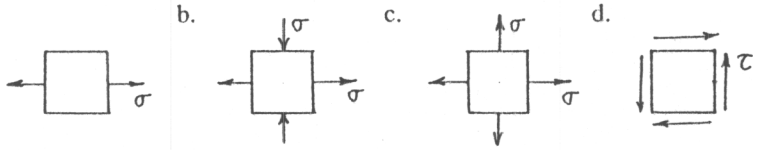


Fig. 2.2

4、(1) 請繪出以下四種簡單應力狀態的摩氏圓(Mohr's Circle)：(16%)

a. b. c. d.



(2) 我們常用最大畸變形應變能理論(Maximum distortional energy theory or von-Mises yield theory) 預測機械元件的降伏狀態，在平面應力狀態下，此理論的公式如下，請推導之：(10%)

$$\sigma_1^2 - \sigma_1\sigma_2 + \sigma_2^2 = \sigma_{ys}^2$$

其中 σ_1, σ_2 爲主應力，σ_{ys} 爲材料之降伏強度。

(3) 在推導第(2)部分之公式時，我們做了什麼假設？(5%)

(4) 第(1)部分所列的四種應力狀態，何者不影響機械元件的降伏狀態？(4%)

5、我們若對一支粉筆施以扭力後斷裂，請解釋它的斷裂情形，還有你根據那個理論預測？(15%)