1. 組合梁 ABCDE 如圖一 (Figure 1) 所示，係由兩梁 (AD 及 DE) 在 D 處銜接而成，梁上負載包括作用在固定於 B 處托架之末端的 4 kN 力及作用在梁 DE 中點的力 2 kN，試繪出梁 ABCDE 的剪力圖及彎矩圖。（注意：計算時忽略梁及托架的寬度，採用中心線的尺寸）(20 分)

![Figure 1.](image)

2. 高 5 ft 之某擋土牆是由 3 in. 厚的水平木板做成，木板則以直徑 12 in. 的鉛直木樁支持，如圖二 (Figure 2) 所示，牆頂部的横向土塹壓力為 \( p_1 = 100 \text{ lb/ft}^2 \)，底部則為 \( p_2 = 400 \text{ lb/ft}^2 \)。若木樁及木板之容許拉應力與壓應力均為 1200 psi，試求樁的最大容許間隔 s 為何？（提示：樁的間隔可能決定於水平木板或鉛直木樁的負載承受能力） (20 分)

![Figure 2.](image)
3. A reinforced concrete pedestal is subjected to a compressive force $P$ as shown in Figure 3. It is constructed with 12 steel bars, each bar has diameter $d = 25$ mm. Assuming linear elastic behavior, calculate the maximum permissible load $P$ if the allowable stresses in the steel and concrete are 70 MPa and 8 MPa, respectively. (20 分)

(Young’s modulus of steel and concrete: $E_s = 200$ GPa, $E_c = 25$ GPa; neglect the weight of the pedestal itself)

![Figure 3](image)

4. At a point on the surface of a generator shaft the stresses are as shown in Figure 4. Using Mohr’s circle, determine the following quantities: (a) the stresses acting on an element inclined at an angle $\theta = 45^\circ$, (b) the principal stresses, and (c) the maximum shear stresses. (Consider only the in-plane stresses, and show all results on sketches of properly oriented elements.) (20 分)

![Figure 4](image)
5. A slender column with rectangular cross-sectional dimensions $b$ and $h$ ($h=1.5b$) is as shown in Figure 5. (a) if the column is pin-support at ends A and C only, express the Euler load in terms of $E$, $L$, $b$. (b) if the column is further restrained in the plane of the figure at the midheight but is free to deflect perpendicular to the plane of the figure (except at ends A and C), again, find the Euler load in terms of $E$, $L$, $b$. (c) Sketch the buckled shaped for both cases (a) and (b), properly use a set of axes and indicate the planes where buckling occurred. (20 分)

![Figure 5.](image-url)