國立成功大學

112學年度碩士班招生考試試題

編　號：67

系　所：機械工程學系

科　目：材料力學

日　期：0206

節　次：第 1 節

備　註：可使用計算機

※ 考生請注意：本試題可使用計算機。　請於答案卷(卡)作答，於本試題紙上作答者，不予計分。

Problem 1　(15 Pts)

The vertebra of the spinal column can support a maximum compressive stress of σ, before undergoing a compression fracture. Determine the smallest force P that can be applied to a vertebra, if we assume this load is applied at an eccentric distance e from the centerline of the bone, and the bone remains elastic. Modeling the vertebra as a hollow cylinder with an inner radius r_i and outer radius r_o. (Fig. 1)

Problem 2　(15 Pts)

A thin plate of thickness t is bent to form the beam, in which the cross section is shown as Fig. 2. Determine the location of the shear center O.
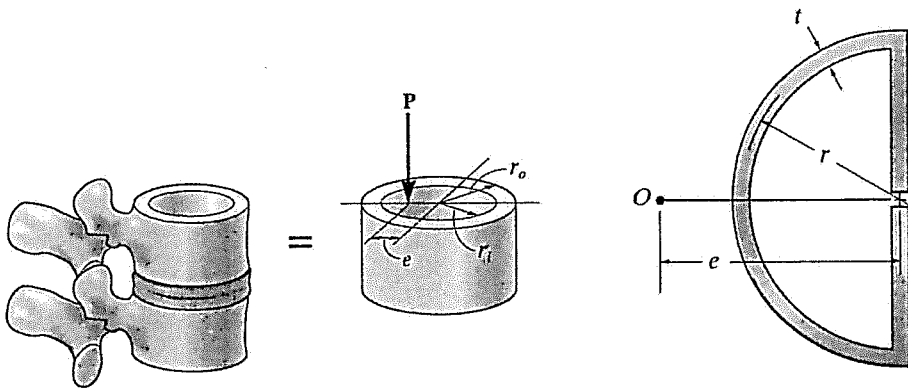

Fig. 1

Fig. 2

Problem 3　(20 Pts)

The box frame is subjected to a uniform distributed loading w along each of its sides. Determine the moment developed in each corner. Neglect the deflection due to axial load. EI is constant. (Fig. 3) Maintaining the right angle and zero slope at the four corner joints.
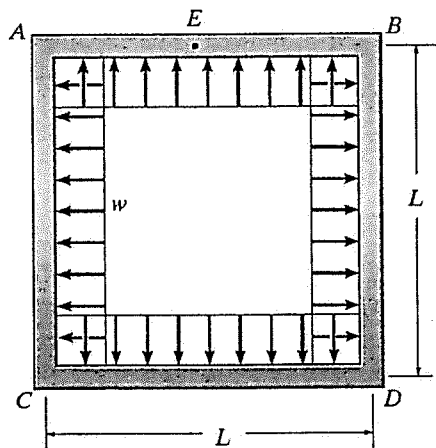

Fig. 3

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Problem 4　　(20 Pts)

A bimetal beam is constructed by binding together two slender beams of rectangular cross section.　Material properties of the component beam differ, including thermal expansion coefficients α_1 and α_2.　With $\alpha_1 < \alpha_2$, uniform heating an amount ΔT causes the deformation shown. Please determine the stress at the lower surfaces of the component beams.
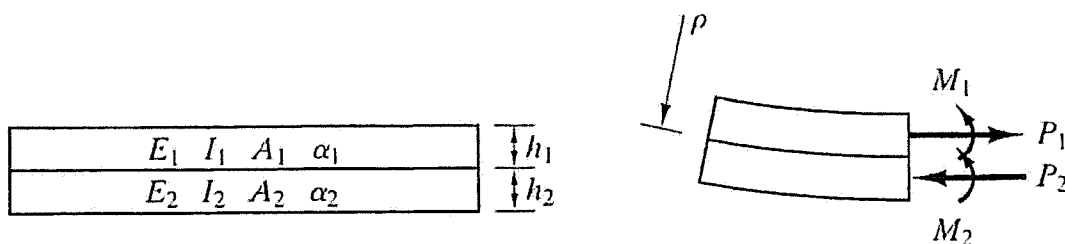
Problem 5　　(15 Pts)

Consider a fixed-fixed beam (Young's modulus E, Poisson's ratio v, moment of inertia I, cross-sectional area A, thickness h, width b, and length L)　subjected to an axial compression load P.

Please determine its critical load of buckling. Specifically, please

(a) Write the beam equation with appropriate boundary conditions.

(b) Find the critical load P_{cr}.

Problem 6.　　(15 Pts)

If σ_x=60 MPa, σ_y= -20 MPa, τ_{xy}=35 MPa, and σ_z=τ_{xz}=τ_{yz}=0, what are the **principal strains**? Let G=70 GPa and v=0.30.