CE469 Advanced Mechanics of Solids Endsem Exam 22/11/05

Marks: 1 → 20, 2 → 25, 3 → 20, 4 → 20, 5 → 15

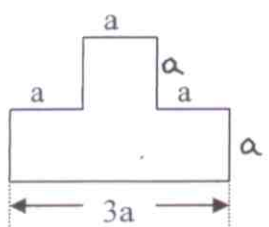
1. The cross-section of a prismatical member is shown in Fig. 1. Using the finite difference method with step size $a/2$, find the twist per unit length (α) in terms of applied torsional moment (M), shear modulus (G), and a.

2. A load (P, $2P$) is applied at the centroid of the free end of a cantilever beam of length L, i.e., at (0, 0, L). The beam has a split circular cross section of mean radius r and uniform thickness t, as shown in Fig. 2. Assume $t << r$, and the gap at the split to be negligibly small so that the centroid coincides with the center of the circle. Find:
   (a) the angle of twist per unit length at the centroid O of the cross section.
   (b) the Neutral Plane.
   (c) the bending stress σ_z at the points A and B shown in Fig. 2.

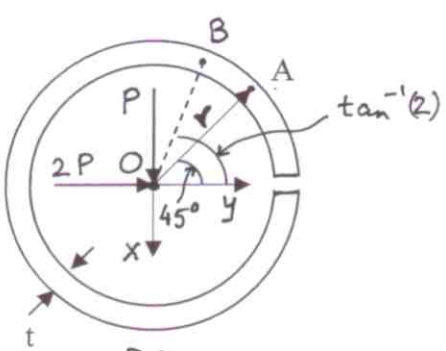
3. Find the maximum tensile stress in the curved part of the hook with circular cross-section and loading as shown in Fig. 3

4. For the 4-parameter viscoelastic model shown in Fig. 4, determine:
   (a) the constitutive law
   (b) the relaxation response, i.e., stress $\sigma[t]$ for step input strain $\varepsilon[t] = \varepsilon_0 u[t]$ where $u[t]$ is the unit step function.
   (c) the asymptotic value $\sigma[\infty]$ based on the result in part (b). Justify your result for $\sigma[\infty]$ based on physical explanation using the given model.

5. For the infinite beam on elastic foundation with uniform loading q as shown in Fig. 5, determine the exact expression for displacement (w), slope (θ), bending moment (M), and shear force (V) at a point H located at a distance a from the right end of the load patch, i.e., outside the load patch, as shown.



P.1



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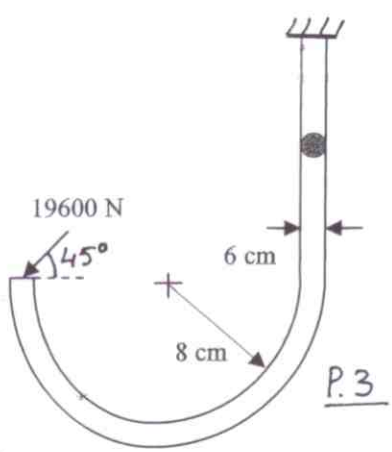

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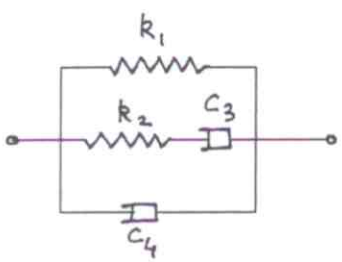

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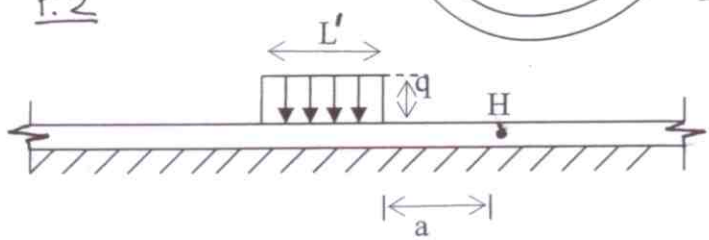

P.5