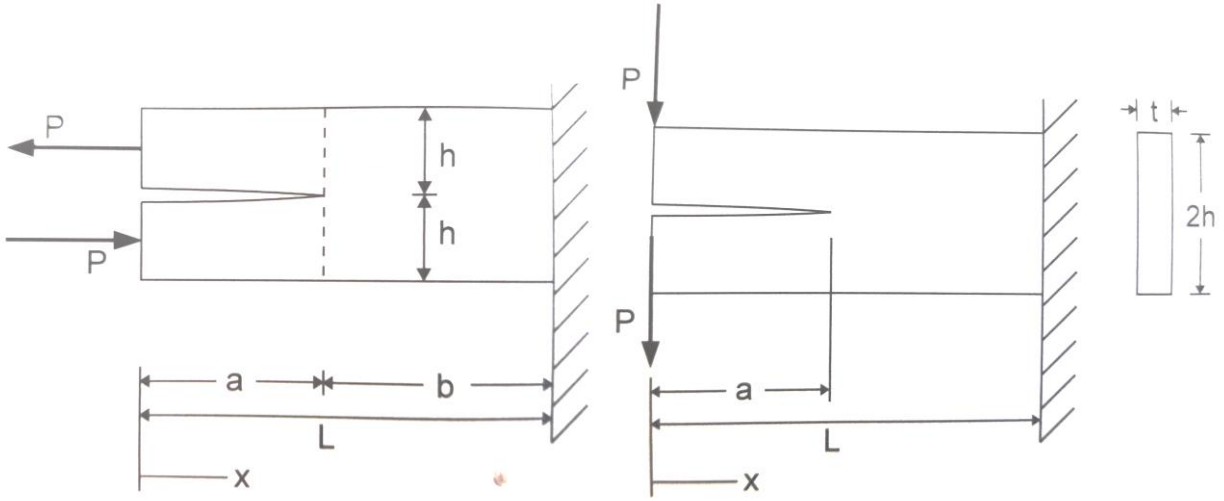
Due: 8:30 AM December 9, Thursday, 2021 (No late homework accepted)

1. (*Fracture mechanics*) Consider the split beam with two different loading conditions shown below. Loadings in both cases are antisymmetric, and both are mode II fracture problems. For the same value of P, which loading is more efficient in cracking the beam? Assume that the beam dimensions and the elastic properties are:

$E = 70$ GPa, $v = 0.3$, $a = 0.1$ m, $t = 0.02$ m, $L = 1.15$ m, $h = 0.01$ m



2. (*Fracture mechanics*) Consider a long thin-walled cylinder of a brittle material subjected to an internal pressure p_0. The diameter of the cylinder is 2 m, the wall thickness is 5 mm, and the mode I fracture toughness of the material (of the same thickness of the wall) is $K_{Ic} = 5$ MP $m^{0.5}$. If there is a through-the-thickness longitudinal crack of 5 cm in length on the cylinder, estimate the maximum internal pressure that the cracked cylinder can withstand. If the cracked cylinder is subjected to a torque and the mode II toughness of the material is the same as that of mode I, estimate the maximum torque. (Hint 1: treat the crack as a central crack in an infinite plate, Hint 2: you need to review the equations from pressure vessels from Aerospace Structures II or Mechanics of Material to link the internal pressure to the stresses acting on the wall of the cylinder.)