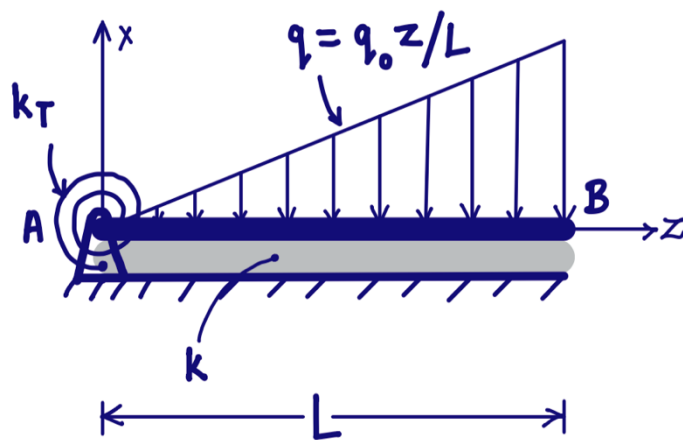


## ME 202 Strength of Materials Spring 2023 Quiz 2 (10 points) 08 Feb 2023

Closed books closed notes. Only one self-handwritten A4 cheat sheet allowed. No extra sheets. Figures not to scale. All structures are weightless. Exam rules are in full force and effect. **10% late penalty for dropbox submissions.**

1. (5 points) AB is a rigid rod (length  $L$ ) pinned at A through a torsion spring of stiffness  $k_T$  Nm/rad. A linearly elastic foam of uniformly distributed stiffness  $k$  N/m<sup>2</sup> is placed under the rod as shown by the shaded area in the figure. A linearly varying load intensity  $q$  N/m is applied to the rod as shown which compresses the elastic foam underneath. Using only the principle of minimum potential energy, find the vertical deflection of B. Hint: recall a similar problem solved in class. Extend the idea to multiple springs and forces, and then to the present case. Note: Do NOT use the force/equilibrium method to solve the problem.



2. (5 points) Consider the elastic beam AB (length  $L$ , flexural rigidity  $EI$ ) pinned to a roller at B and attached to a sliding support at A i.e. A can freely displace vertically without rotation and B can freely rotate without vertical deflection in the plane. A uniformly distributed load intensity  $q$  N/m is applied as shown. [1] Obtain the support reactions and the expression for bending moment [2] integrate the bending moment and apply appropriate boundary conditions to obtain the deflection curve  $u(z)$  [3] determine the location and magnitude of the maximum deflection of the beam.

