CVEN 3161
Mechanics of Materials I

Midterm Examination # 1: Closed Books and Closed Notes, Duration: One Hour

Problem # 1: 40 Points

A conical bar is suspended at the top at section A. Given the specific weight $\gamma$ of the material, what is the behavior of the bar under its own weight? Determine the

(a) internal force diagram $N(x) =$?
(b) normal stress diagram $\sigma(x) =$?
(c) normal strain diagram $\epsilon(x) =$?
(d) axial displacement diagram $u(x) =$?
Problem # 2: 40 Points

A cubical soil specimen \((h \times a \times b = 4 \times 4 \times 4 \text{ in}^3)\) is loaded in the y-direction by the pressure \(p = 1000 \text{ psi}\) in the rigid cavity as shown below. Assuming linear elastic behavior with \(E = 1000 \text{ ksi}\) and \(\nu = 0.2\), and neglecting interface friction,

(a) what are the lateral confining stresses \(\sigma_x = ?\), \(\sigma_z = ?\) in the specimen at the faces of the rigid walls,

(b) what is the axial compaction of the specimen, i.e. what is the change of height \(\Delta h = ?\) of the specimen,

(c) how would the confining stress and the compaction change in case of incompressible behavior?
Problem # 3: 20 Points

(a) Define Poisson’s ratio:

\[ \nu = ? \] \hspace{1cm} (1)

(b) What are upper and lower bound values of Poisson’s ratio?

\[ ? \leq \nu \leq ? \] \hspace{1cm} (2)