ENDS 231. Practice Final Examination

Aids Allowed: Two marked 8.5" x 11" crib pages *(2 pages written on one side only or 1 page written on both sides)* — Silent Calculator — Reference Formulas (Provided at exam time)

Clearly show all your work and record your final answers with the units specified in the boxes.

Problem 1) Worth 45%

- A 28 ft beam with live (including a moment) and dead loading is shown in Figure 1a.
- The cross section geometry of the beam is shown in Figure 1c.
- The material is Giggium steel with E = 32,000 ksi, F_b = 60 ksi, F_v = 35 ksi, F_y = 45 ksi, and F_u = 65 ksi.
- The beam end connection is detailed in Figure 1d. The angle legs are 5/16" thick, with ¾ in diameter bolts of A325-X and standard holes.
- The weld material is E70XX

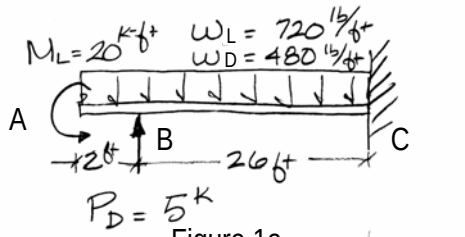

Figure 1a

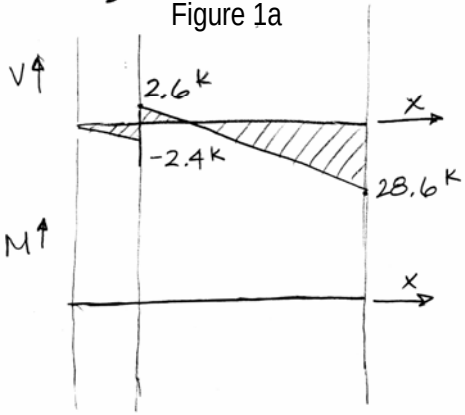

Figure 1b

FIND:

a) The completed bending moment diagram in Figure 1b, and M_{max}.

b) The moment of inertia for the cross section by completing the chart of Figure 1d.

c) The maximum bending stress in the beam.

d) The maximum shear stress in the beam.

e) The deflection due to *dead load only* at the free end *A*.

f) The number of bolts at the beam shear connection required for shear at end *C*.

g) The bearing force allowed at the beam shear connection with 4 bolts.

h) The minimum weld size required for the angles to the column required for shear if the length on each angle is 3.25 in..

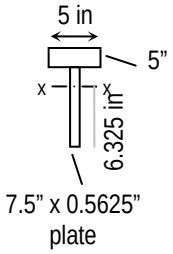

Figure 1c

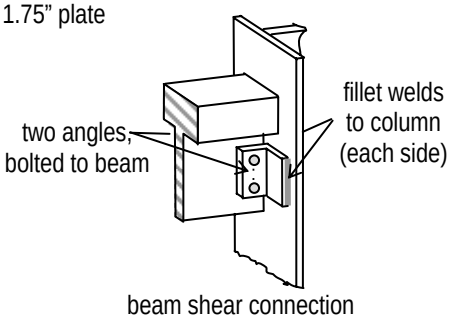

Figure 1d

	$A(in^2)$	$I_x(in^4)$	d_y (in)	$Ad_y^2(in^3)$
▭	8.75	2.23	2.05	36.77
I				

Figure 1e

a)	b) 86.75 in^4
c)	d) 6.59 ksi
e) 2.62 in	f) 2 bolts (>1.08)
g)	h)

Disclaimer: Answers have NOT been painstakingly researched.

Problem 2) Worth 45%

- A parallel chord truss is shown in the Figure 2a has the following support reactions:
  $A_x = 200$ *lb*, $A_y = 647.5$ *lb*, $E = 102.5$ *lb*.
- Snow load is considered.
- The truss is constructed with glu-lam lumber having E =1.85 x 10^6 psi, α = 3.8 x 10^{-6} /°F, F_c = 1700 psi (no adjustment factors), allowable tension stress F'_t = 1200 psi (<u>with</u> adjustment factors), and allowable bearing stress F'_p = 650 psi (<u>with</u> adjustment factors).
- The truss is constructed with 5.125"x10.5" timbers with I_x = 109.9 in^4, and I_y = 19.1 in^4.
- The bottom chord that is continuous the length of the truss is connected as shown in Figure 2b. The joints are considered pinned for analysis.
- The bottom chord is laterally braced at midspan and each end.

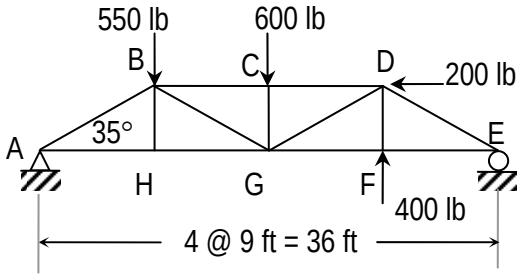

Figure 2a

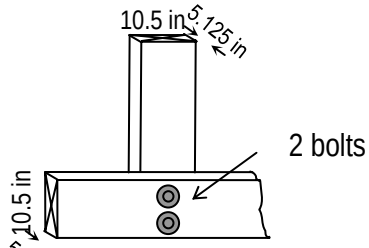

Figure 2b

<u>FIND:</u>

i) The member force in BG using the method of sections.

j) The member force in BC using the method of sections.

k) The area required for member HG if the tension force is 725 lb.

l) The stress in member AB resulting *only* from a temperature increase of 25° F if the member can only lengthen by 0.005 inches.

m) The critical value of F_{CE} for the lower chord.

n) The allowable buckling load for the lower chord if C_p has been determined to be 0.214 for the weak axis and 0.224 for the strong axis.

o) The minimum bolt diameter allowed with two bolts if the maximum tension force in either member in the connection is 8 kips and the hole is 1/8" larger than the bolt.

i)	j)	k)
l) 105.6 psi	m)	n) 22,514 lb
o) 1.2 in (bearing) {< 4.47 in.}		

Disclaimer: Answers have NOT been painstakingly researched.

Problem 3) Worth 10% (conceptual questions)