

UNIVERSITY OF TORONTO
Department of Civil Engineering

CIV100F - MECHANICS – GROUP G (107)

Problem Set 11 (3 Questions in total.)

Due: 4:00 pm on Friday November 23, 2012

In SF3201

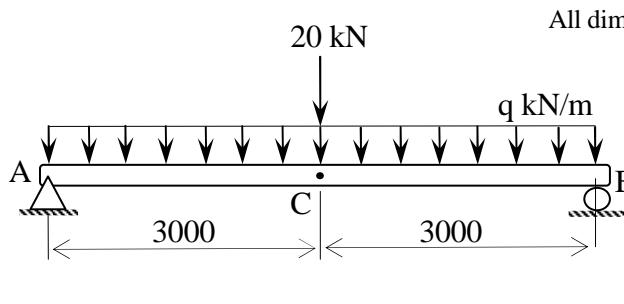


Fig. (a): Beam and Loading

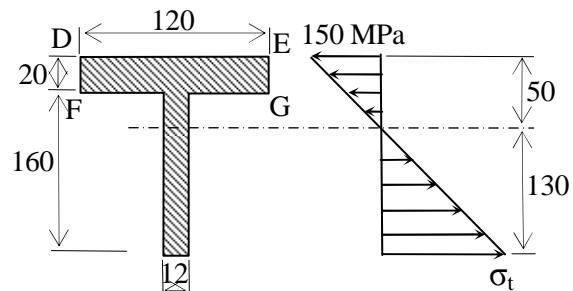


Fig (b): Cross Section and Internal Stresses at C

1. Simply-supported beam AB is subjected to a uniformly-distributed load and a point load as shown in **Fig. (a)**. The cross section of the beam and the stress distribution due to the internal bending moment at C are shown in **Fig. (b)**. The beam is constructed from the structural steel with a yield strength of 400 MPa. Determine:
 - i.) the location of the centroid of the cross section with reference to line DE,
 - ii.) the total compression force acting on the cross section,
 - iii.) the maximum tensile stress, σ_t , (and comment on the adequacy of the cross section)
 - iv.) the magnitude of the internal bending moment at point C,
 - v.) the magnitude of the force acting on DEF, and (indicate whether tension or compression)
 - vi.) the value of the uniformly distributed load, q.

Please turn the page over.

2. Beam AB, supported by a roller at A and a pin at B, is subjected to a uniformly distributed load, a point load and a couple moment as shown in **Fig. (a)**. At point C, the internal stress distribution due to bending of the beam, which has an opening at mid-height, is shown in **Fig. (b)**. Compute:

- i.) the magnitude of the stress σ_c in MPa,
- ii.) the internal bending moment acting on the beam at C in kNm, and
- iii.) the magnitude of the point load P in kN.

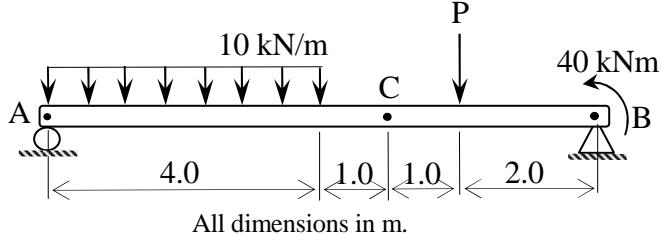


Figure (a)

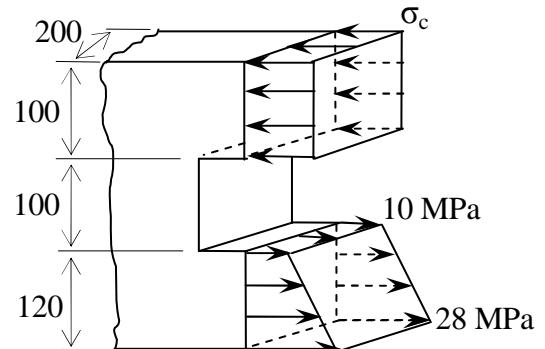


Figure (b)

3. Plate ABCD is supported by a ball-and-socket at A, a cable at B and a special pin at D which only restrains the movements along x- and z-directions. The plate carries a distributed loading as shown. Determine:

- i.) the magnitude, and x and y coordinates of the resultant force acting on the plate, and
- ii.) the force in cable BE. Draw a neat free body diagram at the beginning of your solution. Use a 3D vector approach.

