

MASSACHUSETTS INSTITUTE OF TECHNOLOGY

Department of Mechanical Engineering
2.001 Mechanics and Materials I
Fall 2006

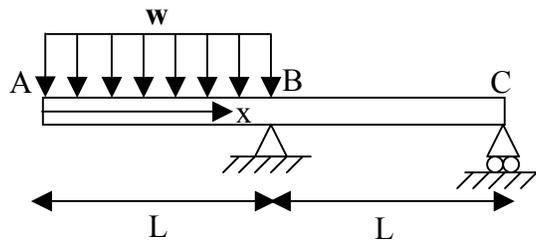
Problem Set 11

Distributed: Wednesday, November 29, 2006

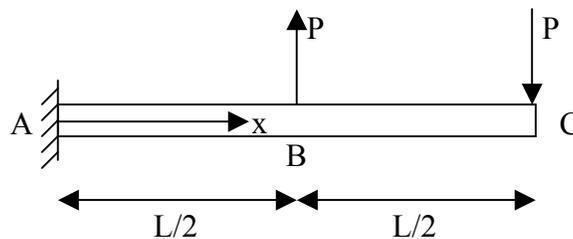
Due: Wednesday, December 6, 2006

Problem 1: Hibbeler 12-15

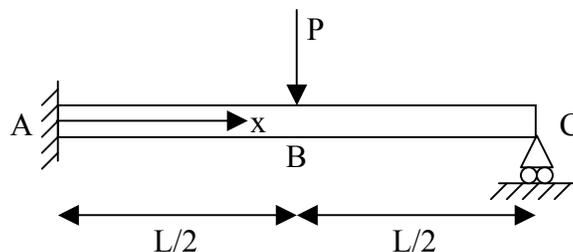
Problem 2: Calculate the deflection $v(x)$ of the beam below by direct integration. What is the deflection of the beam at point A? The beam has a uniform Young's modulus of E , and the moment of inertia of the cross section is I .



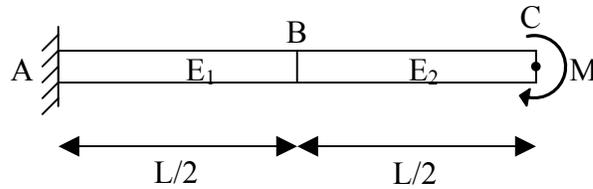
Problem 3: Calculate the deflection and slope at the center of the beam below using superposition and the results in Appendix C.



Problem 4: Using superposition, calculate the deflection in the center (point B) of the beam shown below. The beam has a moment of inertia I and a Young's modulus E .



Problem 5: Calculate the deflection at the tip of the cantilever below. The half near the support has a Young's modulus of E_1 , and the half away from the support has a Young's modulus of E_2 . The moment of inertia of the beam is I all the way along its length. You are welcome to use the table in Appendix C whenever it would be useful.



Problem 6: Consider the composite beam cross section shown below. The top part of the beam (shaded) has a Young's modulus of E_1 , and the bottom part of the beam (hatched) has a Young's modulus of $E_2 = 2E_1$. The directions of y and z are marked; it's up to you to decide where to locate the origin. First locate the neutral axis in the beam. You will now examine the values of stress and strain on the dotted line indicated in the figure. Calculate the strain ϵ_{xx} and the stress σ_{xx} (as a function of the distance y off the neutral axis) that would result from an applied moment M about the z axis. Then graph both ϵ_{xx} and σ_{xx} vs. y .

