University of Asia Pacific
Department of Civil Engineering
Final Examination Spring 2012
Program: B.Sc. Engineering (Civil)

Course Title : Mechanics of Solids II
Time : 3 hour

Course Code: CE 213
Full Marks :10x10=100

(There are 14 questions. Answer **any 10.)**

1. If the section shown in Fig. a is subjected to a 10 kN-m torque, calculate the magnitude of maximum shear stress in that section. Also calculate the depth and width (B) of the section in Fig. b that has the same maximum shear stress when subjected to the same torque.

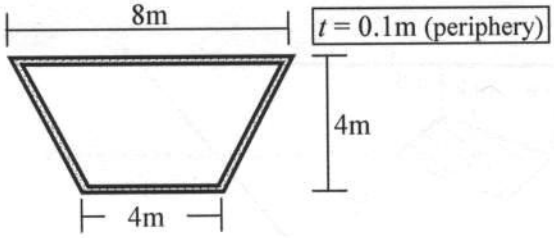


Fig. a

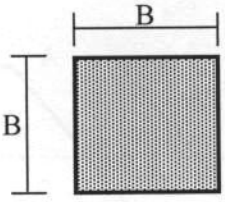
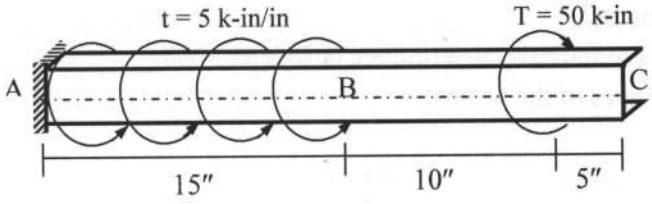
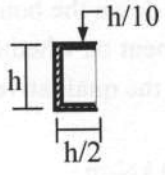


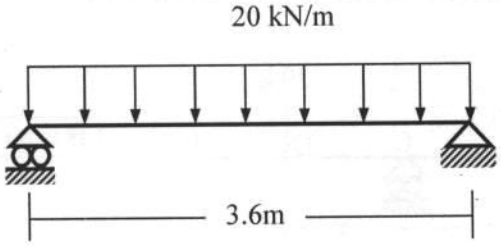
Fig. b

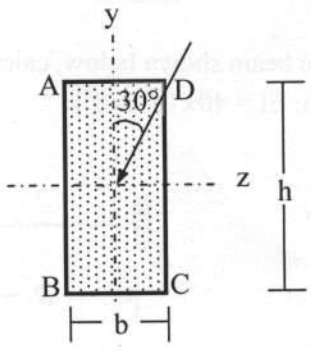
2. Calculate the required depth (h) of the channel section shown below if the allowable shear stress in beam ABC is 12 ksi and the allowable angle of twist is 1° [Given: G = 12000 ksi].



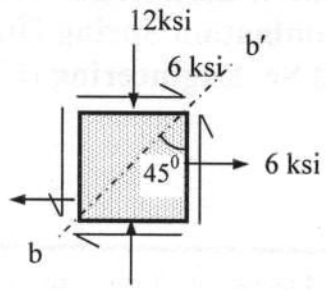


3. A simple beam with depth to width ratio of 2:1 (i.e. h=2b) has a span of 3.6 m and carries a UDL of 15 kN/m as shown below. The loading plane is inclined 30^0 clockwise with vertical. Determine the required dimension (b & h) so that the maximum stress due to bending does not exceed 12 MPa. Neglect self-weight of beam. Also locate the neutral axis.

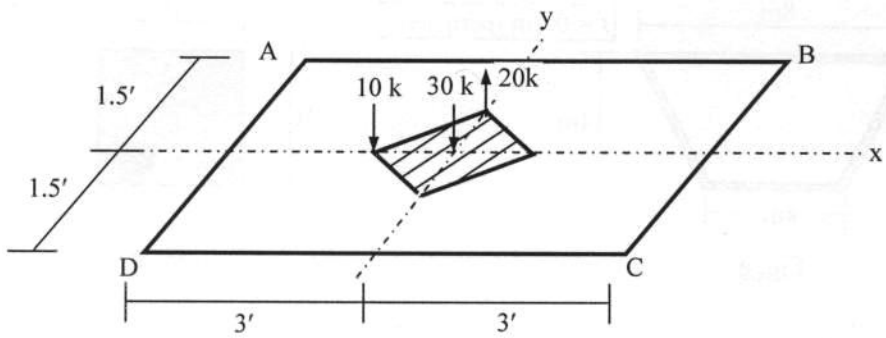




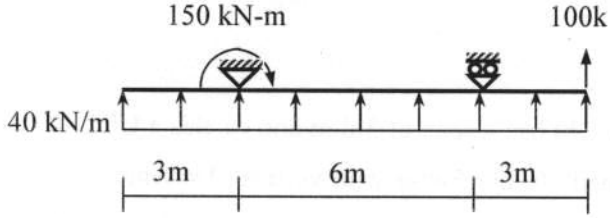
4. Using Mohr's circle of transformation of stress or stress transformation formula determine the normal and shear stresses on plane b-b' along with the principle and maximum shear stress.



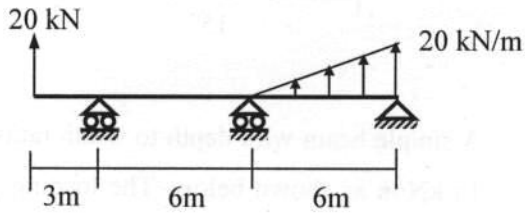
5. a) What do you mean by 'Kern' of a footing?
   b) The shaded area shown below represents the kern of the rectangular footing ABCD. For the given loads calculate the normal stresses at A, B, C and D.



6. For the beams shown below,
   a) Write the expression for loading function w(x) using singularity functions.
   b) Write down the boundary conditions.
   c) Comment on whether the beams are statically determinate or indeterminate.
   d) Draw the qualitative deflected shapes of the beams.

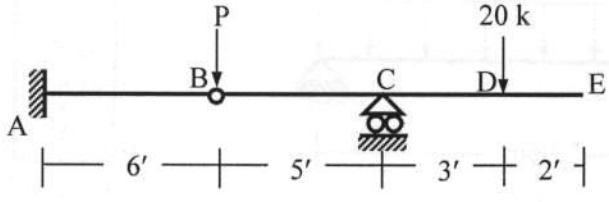


Beam1



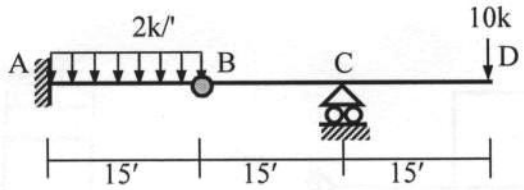
Beam2

7. For the beam shown below, calculate the force P needed to make the deflection at B equal to zero [Given: EI = 40×10^3 k-ft^2].

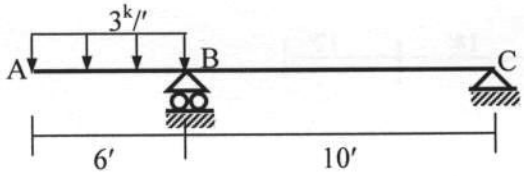


B is an Internal Hinge

8. Use singularity function method to calculate the deflection at D of the beam shown below.

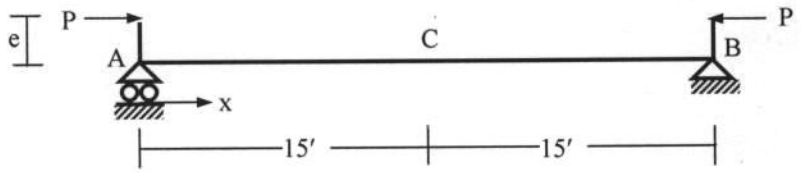


9. Calculate v_A using the moment-area theorems for the following figure [Given, $EI_{AB} = 40{,}000$ k-ft^2, $EI_{BC} = 20{,}000$ k-ft^2].

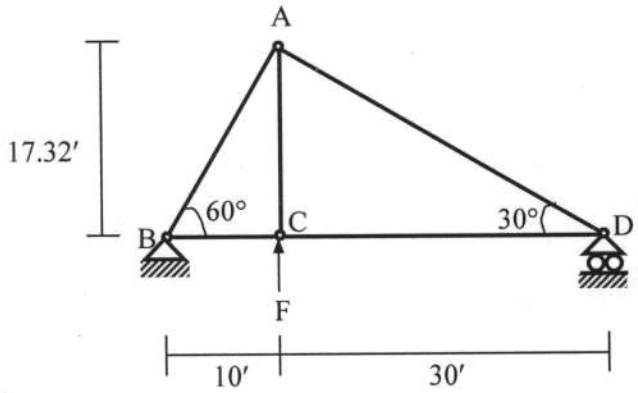


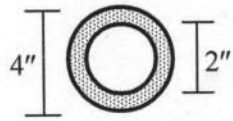
10. Answer Question 9 using the Conjugate Beam Method.

11. The beam ACB shown below is subjected to compressive loads (P) applied at both ends at an eccentricity of 'e'. If the deflection at C for P = 100 kips is 1″, calculate the value of 'e' and the deflection at C for P = 200 kips [Given: $EI = 4\times10^6$ k-in^2].



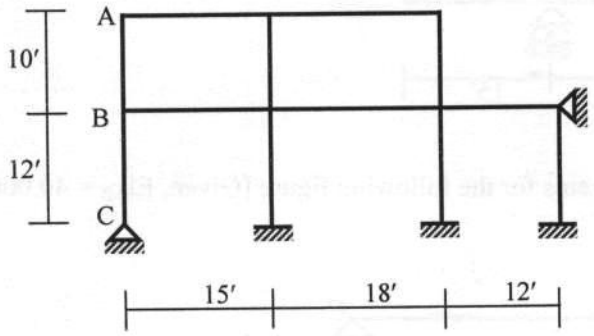
12. Use the AISC-ASD criteria to calculate the allowable value of F to avoid buckling of any member of the truss shown below [Given: Member cross-section is as shown, with E = 29000 ksi, f_y = 40 ksi].

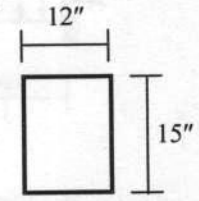




Member
X- Section

13. Calculate the Euler loads for columns AB and BC in the frame shown below [Given: E = 3000 ksi, EI = constant].





Cross-section

14. Prove the Euler formula of critical load for slender column and state the assumptions used for deriving the formula.