These problems address topics from the NCEES FE Civil CBT Exam Specifications at https://ncees.org/wp-content/uploads/FE-Civil-CBT-specs-1.pdf, see below.

YouTube Playlist

FE Civil Review 2022

Mechanics of Materials

NCEES Fundamentals of Engineering (FE)
CIVIL CBT Exam Specifications

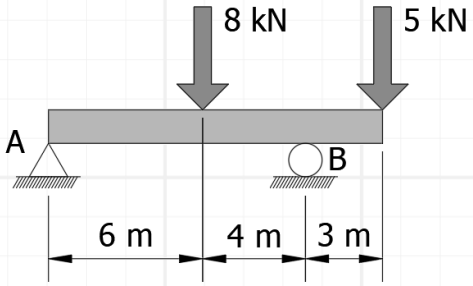
Effective Beginning with the July 2020 Examinations

Knowledge	Number of Questions
6. Mechanics of Materials	**7–11**
A. Shear and moment diagrams	
B. Stresses and strains (e.g., diagrams, axial, torsion, bending, shear, thermal)	
C. Deformations (e.g., axial, torsion, bending, thermal)	
D. Combined stresses, principal stresses, and Mohr's circle	

Notes
V1.00 published 2/5/2022
V1.01 minor updates to questions 5 and 6 2/8/2022
V1.1 title sheet 3/29/2022

A. Shear and moment diagrams

Question 1: A beam with a width of 50 cm and depth of 100 cm is subjected to the loading below. The magnitude of the moment that causes the maximum bending stress in the beam due to the applied loads (ignore self-weight) is most nearly:



A. 10 kN-m

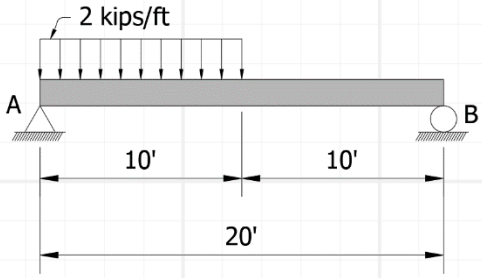
B. 15 kN-m

C. 20 kN-m

D. 25 kN-m

A. Shear and moment diagrams

Question 2: A beam with a width of 6 inches and depth of 12 inches is subjected to the loading below. The magnitude of the moment that causes the maximum bending stress in the beam due to the applied loads (ignore self-weight) is most nearly:



A. 50 kip-ft

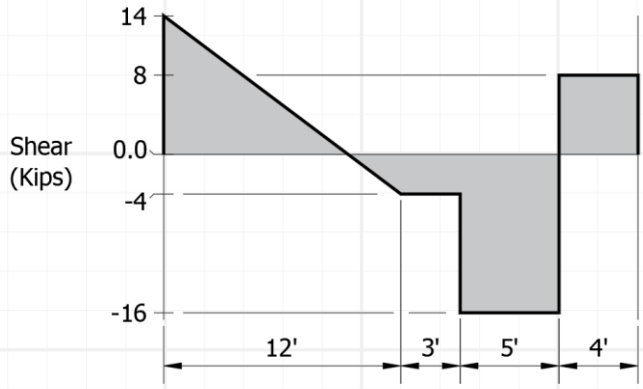
B. 56 kip-ft

C. 100 kip-ft

D. 112 kip-ft

A. Shear and moment diagrams

Question 3: The shear force diagram of a beam is given below where the shear is in kips and distances are measured in feet. No concentrated moments are applied to the beam and all lines are straight. The section is rectangular. The magnitude of the moment that causes maximum bending stress in the beam is most nearly:



A. 32 kip-ft

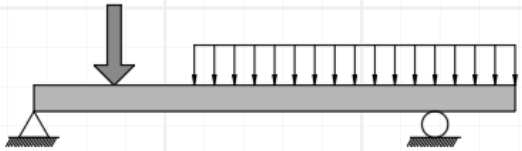
B. 65 kip-ft

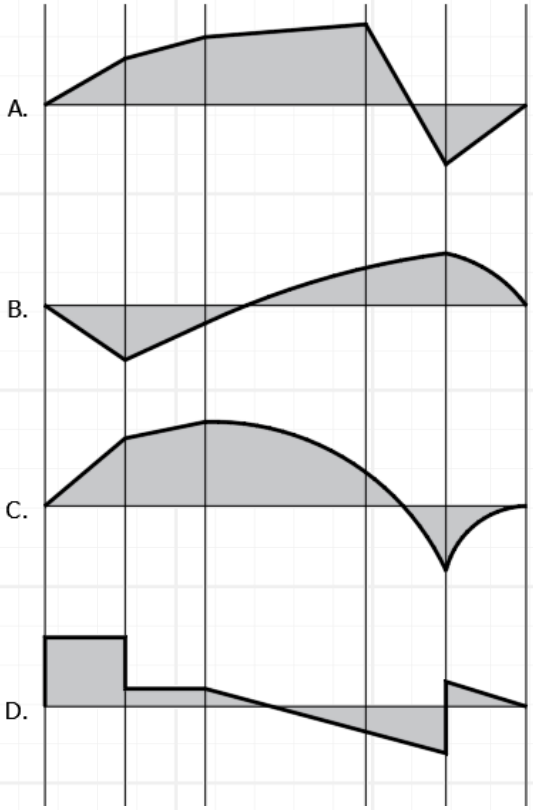
C. 80 kip-ft

D. 92 k-ft

A. Shear and moment diagrams

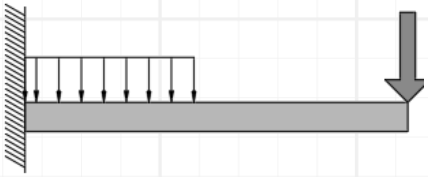
Question 4: The shape of the moment diagram corresponding with the beam and applied loads shown below most nearly matches:

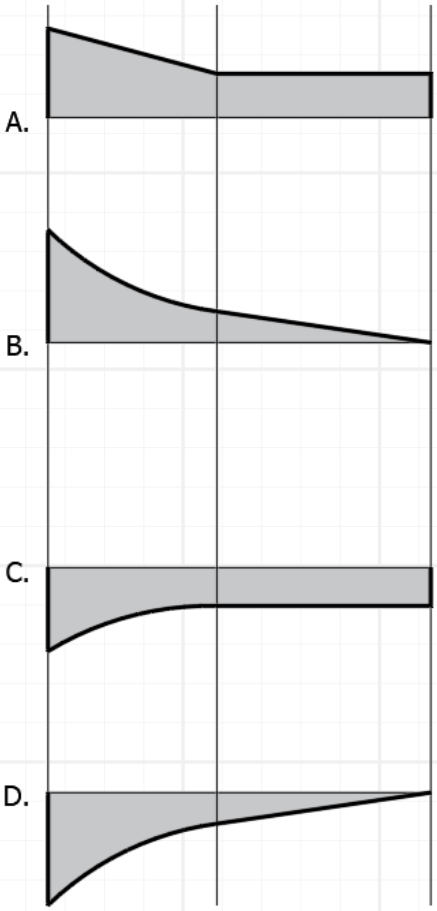




A. Shear and moment diagrams

Question 5: The shape of the moment diagram corresponding with the beam and applied loads shown below most nearly matches:





B. Stresses and strains

Question 6: The following beam is supported by two steel cables that each have a modulus of elasticity of 29,000 ksi and a cross-sectional area of 0.1 ft^2. In addition to supporting the applied load, the weight of the beam is 200 lbs. The strain in cable A is most nearly:

A. 0.2

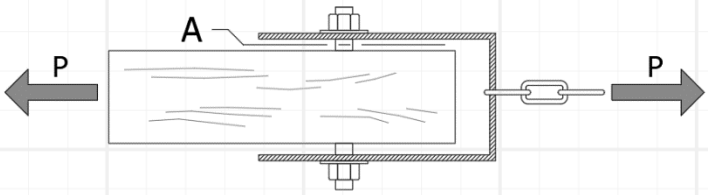
B. 0.002

C. 2×10^{-6}

D. 2×10^{-9}

B. Stresses and strains

Question 7: A clevis used to connect a steel bracket with a block of wood is shown below. If the force P = 15 kN and the bolt has a diameter of 20 mm, the average shear stress in the bolt along line A due to the load P is most nearly:



A. 12 MPa

B. 24 MPa

C. 48 MPa

D. 96 MPa

B. Stresses and strains

Question 8: The maximum torsional shear stress developed in a 10-cm diameter solid steel shaft subjected to an applied torque of 50 kN-m is most nearly:

A. 0.25 MPa

B. 3 MPa

C. 30 MPa

D. 255 MPa

C. Deformations

Question 9: The maximum angle of twist developed in a 4-m long aluminum shaft with a diameter of 12-cm when subjected to a torque of 50 kN-m is most nearly:

A. 0.4°

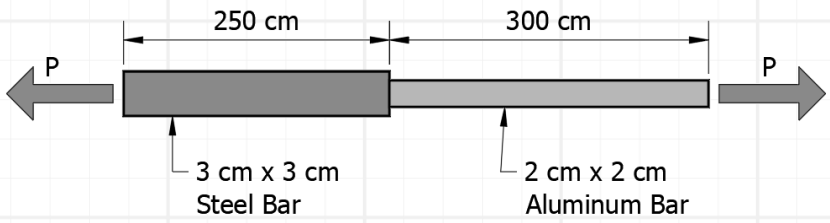
B. 1.4°

C. 5.4°

D. 22°

C. Deformations

Question 10: A composite member is shown below with properties and dimensions given. The magnitude of the axial force P that will cause the total length of the member to increase by 5 mm is most nearly:



A. 0.01 kN

B. 0.1 kN

C. 40 kN

D. 40,000 kN

C. Deformations

Question 11: A copper pipe with diameter of 19 mm and thickness of 1 mm is rigidly installed between two fixtures that are 4 m apart at a temperature of 20°C. After the initial installation, there is no axial stress in the pipe. If temperature of the liquid used in the pipe is 5°C, the magnitude of the axial stress in the pipe is most nearly:

A. 5 MPa

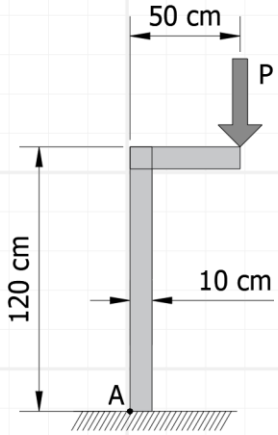
B. 29 MPa

C. 48 MPa

D. 53 MPa

D. Combined stresses, principal stresses, Mohr's circle

Question 12: The bracket shown in the figure below supports a force as shown. Assume buckling will not control. The cross-section of the column is 10-cm x 10-cm square and the force P = 15 kN. The maximum combined stress at the base of the column at point A due to force P is most nearly:



A. 1.5 MPa

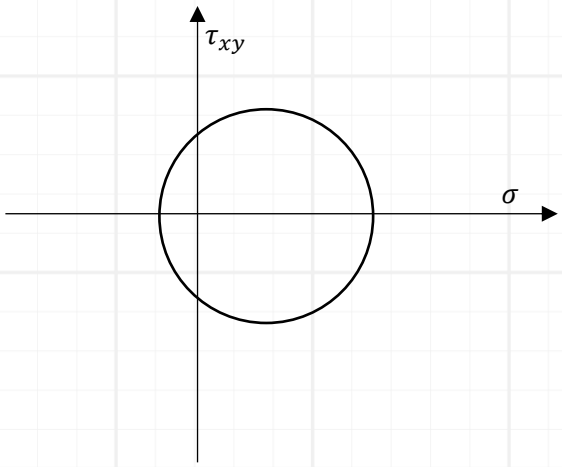
B. 43.5 MPa

C. 45.0 MPa

D. 46.5 MPa

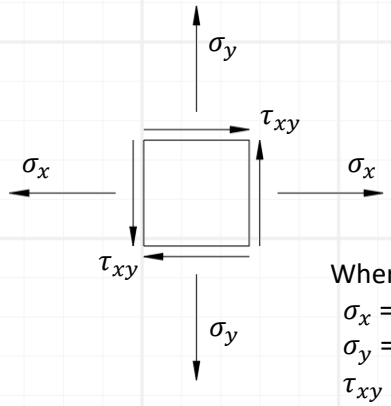
D. Combined stresses, principal stresses, Mohr's circle

Question 13: Mark the location of the principal stresses on Mohr's circle.



D. Combined stresses, principal stresses, Mohr's circle

Question 14: An element experiences the axial and shear stresses indicated in the figure below. The principal stresses are most nearly:



Where:
σ_x = 30 MPa
σ_y = 90 MPa
τ_{xy} = 55 MPa

A. 30 MPa, 90 Mpa

B. 0 MPa, 125 MPa

C. -3 MPa, 122 MPa

D. -62 MPa, 62 MPa