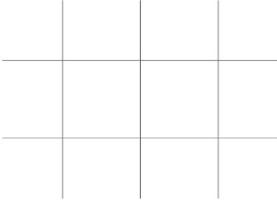




FE 

civil
practice exam

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About NCEES

NCEES is a nonprofit organization made up of the U.S. engineering and surveying licensing boards in all 50 states, U.S. territories, and the District of Columbia. We develop and score the exams used for engineering and surveying licensure in the United States. NCEES also promotes professional mobility through its services for licensees and its member boards.

Engineering licensure in the United States is regulated by licensing boards in each state and territory. These boards set and maintain the standards that protect the public they serve. As a result, licensing requirements and procedures vary by jurisdiction, so stay in touch with your board (ncees.org/licensing-boards).

Exam Format

The FE exam contains 110 questions and is administered year-round via computer at approved Pearson VUE test centers. A 6-hour appointment time includes a tutorial, the exam, and a break. You'll have 5 hours and 20 minutes to complete the actual exam.

In addition to traditional multiple-choice questions with one correct answer, the FE exam uses common alternative item types such as

- Multiple correct options—allows multiple choices to be correct
- Point and click—requires examinees to click on part of a graphic to answer
- Drag and drop—requires examinees to click on and drag items to match, sort, rank, or label
- Fill in the blank—provides a space for examinees to enter a response to the question

To familiarize yourself with the format, style, and navigation of a computer-based exam, view the demo on ncees.org/ExamPrep.

Examinee Guide

The *NCEES Examinee Guide* is the official guide to policies and procedures for all NCEES exams. During exam registration and again on exam day, examinees must agree to abide by the conditions in the *Examinee Guide*, which includes the CBT Examinee Rules and Agreement. You can download the *Examinee Guide* at ncees.org/exams. It is your responsibility to make sure you have the current version.

Scoring and reporting

Exam results for computer-based exams are typically available 7–10 days after you take the exam. You will receive an email notification from NCEES with instructions to view your results in your MyNCEES account. All results are reported as pass or fail.

Updates on exam content and procedures

Visit us at ncees.org/exams for updates on everything exam-related, including specifications, exam-day policies, scoring, and corrections to published exam preparation materials. This is also where you will register for the exam and find additional steps you should follow in your state to be approved for the exam.



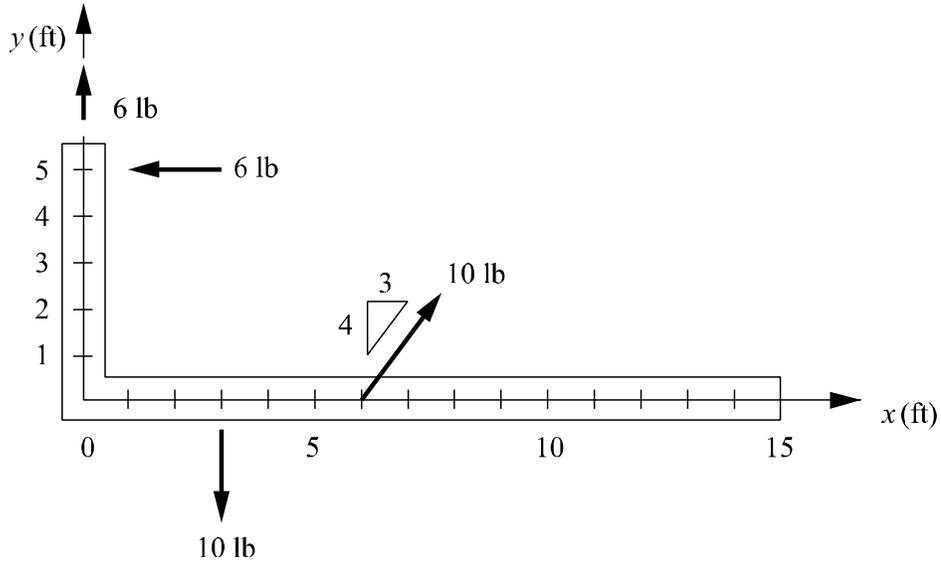
PRACTICE EXAM

FE CIVIL PRACTICE EXAM

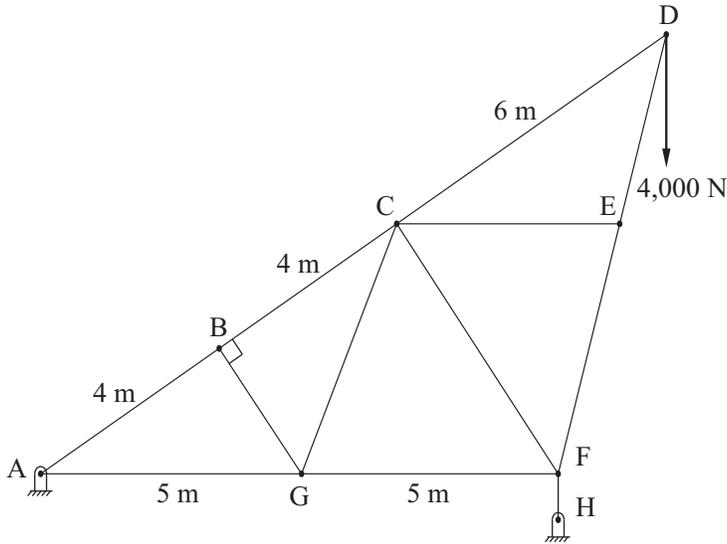
10. An engineer testifying as an expert witness in a product liability case should:
- A. answer as briefly as possible only those questions posed by the attorneys
 - B. provide an evaluation of the character of the defendant
 - C. provide a complete and objective analysis within his or her area of competence
 - D. provide information on the professional background of the defendant
11. As a professional engineer originally licensed 30 years ago, you are asked to evaluate a newly developed computerized control system for a public transportation system. The owner requires a currently licensed engineer to evaluate the system. You may accept this project if:
- Select **all** that apply.
- A. you are competent in the area of computerized control systems
 - B. your professional engineering license has lapsed, but you have two FE interns working for you
 - C. you took a transportation course in college
 - D. you have regularly attended meetings of a professional engineering society
 - E. you have another licensed engineer work for you who is competent in this area, and he or she will conduct all related work and stamp the related design
12. A lien is a:
- A. claim on property for payment of a debt
 - B. requirement that a contractor secure a performance bond for a project
 - C. requirement that a contractor secure a payment bond for a project
 - D. claim for damages for lack of specific performance

FE CIVIL PRACTICE EXAM

20. Select the location on the x -axis where an additional load must be placed in order to achieve equilibrium of the L-shaped bar.



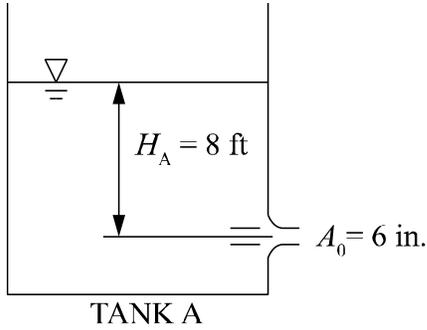
21. The figure below shows a simple truss. Which members in the truss have no (zero) force in them?



- A. BG, CG, CF, CE
- B. BG, CE
- C. CG, CF
- D. CF

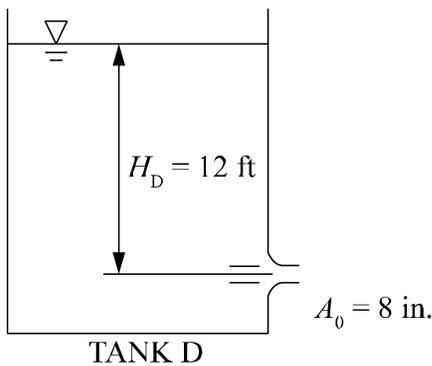
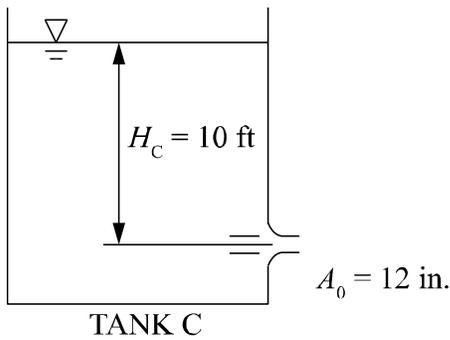
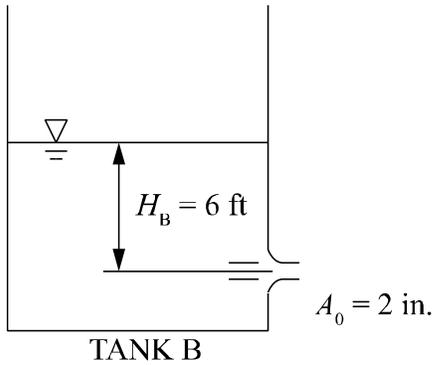
FE CIVIL PRACTICE EXAM

47. Four water tanks are shown with varying water heights H and varying nozzle cross-sectional areas A_0 . Assume no minor losses in the discharge and a common coefficient of discharge $C = 0.6$ for all the nozzles. Match the discharge velocity (ft/sec) to the correct tank.



Discharge Velocity (ft/sec)

- 13.6
- 11.8
- 14.3
- 15.2
- 16.7



FE CIVIL PRACTICE EXAM

89. At two-way stop-controlled intersections, the sight distance required for minor street movements is determined by:
- A. approach sight triangles
 - B. departure sight triangles
 - C. stopping sight distance
 - D. decision sight distance
90. For a given loading, soil conditions, and design life, which of the following pavement types will most likely be the thinnest highway pavement design?
- A. Hot-mix asphalt
 - B. Warm-mix asphalt
 - C. Portland cement concrete
 - D. Composite hot-mix asphalt over Portland cement concrete
91. Which of the following statements about a basic freeway segment are true according to the *Highway Capacity Manual*?
- Select **all** that apply.
- A. Freeway segments with 75-mph free-flow speed experience a reduction in operating speeds at a lower-volume threshold than a freeway segment with a 55-mph free-flow speed.
 - B. The free-flow speed of a freeway segment is impacted by the amount of lateral clearance on the right side of the roadway.
 - C. The capacity of a freeway segment with a 75-mph free-flow speed is higher than a similar facility with a 55-mph free-flow speed.
 - D. A freeway segment with 13-ft lanes has higher free-flow speeds than a similar facility with 12-ft lanes.
 - E. Increases in traffic volume lower the estimated operating speed of a freeway segment for both low- and high-volume ranges.

SOLUTIONS

FE CIVIL SOLUTIONS

9. Refer to the Ethics chapter of the *FE Reference Handbook*.

Section B.1 in the Rules of Professional Conduct states: Licensees shall undertake assignments only when qualified by education or experience in the specific technical fields of engineering or surveying involved.

THE CORRECT ANSWER IS: C

10. Refer to the NCEES Rules of Professional Conduct in the Ethics chapter of the *FE Reference Handbook*.

Licensees may express a professional opinion publicly only when it is founded on adequate knowledge of the facts and a competent evaluation of the subject matter.

THE CORRECT ANSWER IS: C

11. Refer to the NCEES Rules of Professional Conduct, Section B, in the Ethics chapter of the *FE Reference Handbook*.

THE CORRECT ANSWERS ARE: A, E

12. *Black's Law Dictionary* defines *lien* as a claim on property for payment of debt. Examinees are expected to be familiar with liens.

THE CORRECT ANSWER IS: A

13. Refer to the capital recovery equation in the Engineering Economics chapter of the *FE Reference Handbook*.

$$A = P (A/P, i\%, n)$$

$$= 100,000 (A/P, 1\%, 60)$$

$$= 100,000 (0.0222)$$

$$= \$2,220/\text{month}$$

THE CORRECT ANSWER IS: B

FE CIVIL SOLUTIONS

20. Refer to the Systems of Forces section in the Statics chapter of the *FE Reference Handbook*.

$$\Sigma F_x = 0 = -6 + \frac{3}{5}10 \quad \text{Therefore, no additional } x\text{-force required}$$

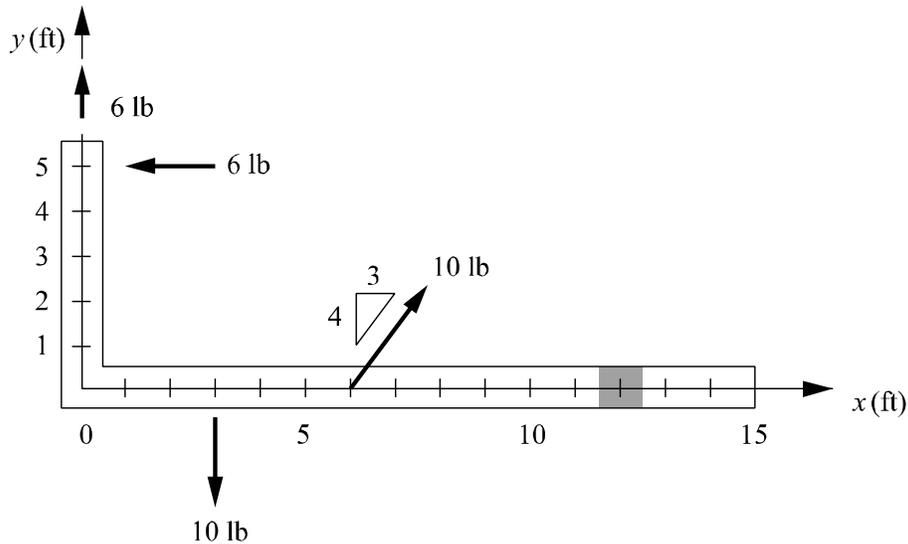
$$\Sigma F_y = 0 \neq 6 - 10 + \frac{4}{5}10 \quad \text{Therefore, additional } y\text{-force required}$$

$$\Sigma F_y = 0 = 6 - 10 + \frac{4}{5}10 + P_y$$

$$P_y = -4 \downarrow$$

$$\Sigma M_o = 0 = 6(5) - 10(3) + \frac{4}{5}10(6) - 4(x)$$

$$x = 12$$

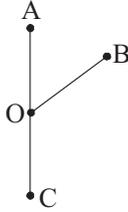


THE CORRECT ANSWER IS SHADED ABOVE.

FE CIVIL SOLUTIONS

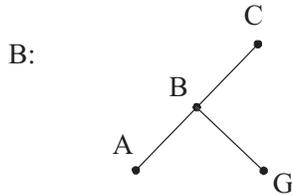
21. Refer to the Statically Determinant Truss section in the Statics chapter of the *FE Reference Handbook*.

Zero-force members usually occur at joints where members are aligned as follows:

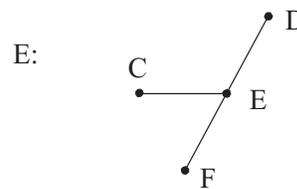


That is, joints where two members are along the same line (OA and OC) and the third member is at some arbitrary angle create a zero-force member. That member (OB) is a zero-force member because the forces in OA and OC must be equal and opposite.

For this specific problem, we immediately examine Joints B and E:

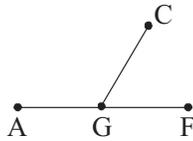


BG is a zero-force member



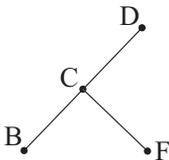
CE is a zero-force member

Now, examine Joint G. Since BG is zero-force member, the joint effectively looks like:



and, therefore, **CG** is another zero-force member.

Finally, examine Joint C. Since both CG and CE are zero-force members, the joint effectively looks like:



and, therefore, **CF** is another zero-force member. Thus, BG, CE, CG, and CF are the zero-force members.

THE CORRECT ANSWER IS: A

FE CIVIL SOLUTIONS

46. Refer to the Characteristics of a Static Liquid section in the Fluid Mechanics chapter of the *FE Reference Handbook*.

The mean pressure of the fluid acting on the gate is evaluated at the mean height, and the center of pressure is $2/3$ of the height from the top; thus, the total force of the fluid is:

$$F_f = \rho g \frac{H}{2} (H) = 1,600(9.807) \frac{3}{2} (3) = 70,610 \text{ N}$$

and its point of application is 1.00 m above the hinge. A moment balance about the hinge gives:

$$F(3) - F_f(1) = 0$$

$$F = \frac{F_f}{3} = \frac{70,610}{3} = 23,537 \text{ N}$$

THE CORRECT ANSWER IS: C

47. Refer to the Orifice Discharging Freely into Atmosphere section in the Fluid Mechanics chapter of the *FE Reference Handbook*.

$$Q = CA_0(2gh)^{1/2}$$

$$Q = VA$$

$$V = C(2gh)^{1/2}$$

$$V_A = 0.6(2 \times 32.2 \text{ ft/sec}^2 \times 8 \text{ ft})^{1/2} = 13.6 \text{ ft/sec}$$

$$V_B = 0.6(2 \times 32.2 \text{ ft/sec}^2 \times 6 \text{ ft})^{1/2} = 11.8 \text{ ft/sec}$$

$$V_C = 0.6(2 \times 32.2 \text{ ft/sec}^2 \times 10 \text{ ft})^{1/2} = 15.2 \text{ ft/sec}$$

$$V_D = 0.6(2 \times 32.2 \text{ ft/sec}^2 \times 12 \text{ ft})^{1/2} = 16.7 \text{ ft/sec}$$

THE CORRECT ANSWER IS SHOWN.

FE CIVIL SOLUTIONS

88. Refer to the Traffic Safety Equations section in the Civil Engineering chapter of the *FE Reference Handbook*.

Crash factors are not additive, so combined CR

$$\begin{aligned} CR &= CR_1 + (1 - CR_1) CR_2 && \text{(order CRs from highest to lowest)} \\ &= 0.25 + (1 - 0.25)0.15 \\ &= 0.36 \end{aligned}$$

$$\text{Crashes prevented} = N \times CR \left(\frac{\text{ADT after}}{\text{ADT before}} \right)$$

1 since no change in ADT

$$\begin{aligned} 3.6 &= 10 \times 0.36 \\ 10 - 3.6 &= 6.4 \end{aligned}$$

THE CORRECT ANSWER IS: D

89. Departure sight triangles are based on a vehicle stopped at the stop bar and looking at major street vehicles for acceptable gaps.

THE CORRECT ANSWER IS: B

90. Asphalt or any combination with asphalt will be thicker under identical conditions.

THE CORRECT ANSWER IS: C

FE CIVIL SOLUTIONS

91. Refer to the Basic Freeway Segment Highway Capacity section in the Civil Engineering chapter of the *FE Reference Handbook*.

Option A: Not true. A 75-mph free-flow speed freeway has a breakpoint of 1,000 pc/h/ln, while a 55-mph freeway has a breakpoint of 1,800 pc/h/ln. The breakpoint is defined by the *Highway Capacity Manual* as the volume for which the operating speeds becomes lower than the free-flow speed.

Option B: True. The free-flow speed is impacted by the lane width, right side lateral clearance, and the total ramp density (TRD).

Option C: True. The capacity of a 75-mph free-flow speed freeway is 2,400 pc/h/ln, while a similar facility with a 55-mph free-flow speed has a capacity of 2,250 pc/h/ln.

Option D: Not true. Lane widths equal to 12 ft and greater have the same free-flow speed. Increasing lane widths only increases speeds when the lane widths are 12 ft or less.

Option E: Not true. The estimated operating speed is impacted only once the volumes exceed the breakpoint volume; therefore there is no impact to operating speed changes in volumes when traffic volumes are low.

THE CORRECT ANSWERS ARE: B, C

92. Refer to the Logit Models section in the Civil Engineering chapter of the *FE Reference Handbook*.

$$P(x) = \frac{e^{Ux}}{\sum_{x=1}^n e^{Ux_i}}$$

Three modes available: drive alone, carpool, and transit

$$P(x) = \frac{e^{U_{\text{carpool}}}}{e^{U_{\text{carpool}}} + e^{U_{\text{drive alone}}} + e^{U_{\text{transit}}}}$$

$$P(x) = \frac{e^{-0.40}}{e^{-0.40} + e^{1.2} + e^{-0.65}} = \frac{0.67}{0.67 + 3.32 + 0.52} = 0.15 = 15\%$$

THE CORRECT ANSWER IS: B